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Vol. VIII. NEW YORK, DEC. 18, 1886. No. 25.

THE Western Union surplus has a fine healthy look about it, being over six million dollars. But it doth not yet appear how much of that sum is in hard, cold cash, available for dividends and the purchase of Christmas presents.

MR. GOULD says there is no desire on the part of the Western Union Company to come to terms with the Baltimore & Ohio Company, and Mr. Garrett says he knows of no intention to make any sort of combination. Meantime the air is full of "pool" talk and—the rates are cut again.

THE uses of carbon in electrical applications are so important that the discovery of a new and practically inexhaustible source of pure carbon is of interest. It is claimed that carbonized sea-weed possesses all the requisites of purity and ease of working necessary to a varied application. Note is made of this in another column, It is but natural to suppose that this plant would contain some sea-salts in its ash, but these may perhaps be gotten rid of by being dissolved out of the mass.

MR. A. RECKENZAUN is contributing to the London *Electrical Review* some of his practical notes on secondary batteries. We reproduce a portion in this issue. As Mr. Reckenzaun puts it after a prolonged experience of his own: "There are numerous instances where the advantages of storage batteries outweigh the evil of waste entirely, where they come in not only as a great convenience but with absolute economy." As evidence of the rehabilitation of the secondary battery in England, he mentions that two or three of the leading manufacturers of them there—to say nothing of the smaller firms—have sold $300,000 worth in the last twelve months, the sum representing about 1,000 tons of cells.

THERE is nothing which evokes more successfully the latent resources of inventors than a war, whether the latter be waged between two nations or between a telephone company and its subscribers. The most recent telephone war, that in Rochester, has brought out a "make and break" transmitter, which is said to operate efficiently, and in one form of which the curious property of the expansion of iron under the influence of the current is made use of. While this action probably takes place in the instrument described in another column, its effective power seems to us to be small in comparison with the primary motion produced by the impinging of the sound waves. Still the idea is ingenious, and might perhaps be employed in other ways to produce a rapid "break.' Perhaps the Bell Company is of opinion that those other ways afford it the most hopeful career of usefulness at present.

THE description of a new locomotive headlight calls attention to a curious fact which, if it should prove true, may have an important bearing on the arc light industry. According to the inventor, it would seem that a negative electrode of copper can be safely employed instead of the usual carbon in an arc lamp. The use of metallic electrodes has been largely experimented with, and though the action noted, viz., the deposition of the carbon, has also been observed, the results obtained have not, thus far, warranted the use of metallic "points." The inventor claims, however, that by the use of a short arc, with low E. M. F. and large current, he succeeds in preventing the fusing of the metal, which is shielded by the tip of deposited carbon. The question of an indestructible electrode for arc lamps is one that is well worthy of study, for, as is well known, the cost of carbons and renewing them is one of the principal items of expense in arc lighting.

TROUBLE between the Stock Exchange and the bucket shops is unending. Our columns give a full account this week of the last row, which takes the shape of a triangular or quadrangular duel, in which Stock Exchange authorities, the "ticker" companies, and the bucket shops are concerned. The mystery that agitates all Wall street is the ease with which the unlicensed practitioners obtain their quotations, in one instance no fewer than fifty-four of the shops being supplied from one distributing house. It is alleged that the Commercial Cable Company, in collusion with the Baltimore & Ohio Company, is the offender in this glaring case, but the Commercial Company denies the allegation, flouts the allegator, accuses the Gold & Stock Company of being the guilty party, and offers $500 as a reward to any one who will find out how the quotations are obtained. There should not be so very much difficulty in winning that money, and we are not surprised to hear that a number of operators and linemen are bent on getting it. It is not outside the bounds of probability that somebody may be reading off the quotations by induction, through the telephone lines, but we fancy the service is a trifle more direct and easy than that.

NOTWITHSTANDING the unqualified success scored by electric traction at the Antwerp Exhibition in 1885, the same system, that of M. Julien, was again entered for competition at Paris this year. In submitting his system to a second ordeal, M. Julien's purpose was, we understand, to confirm, if possible, the results previously arrived at, and, as he expected, they were even better than the first. This is not to be wondered at. At the time of the publication of the Antwerp report, we remarked that the conditions of generating the current were quite unfavorable for high economy. What makes the present test all the more worthy of note is the undoubted eminence and integrity of the jury, which includes some of the most prominent electricians in France, and for that matter in the world. Among them are some who have from the beginning been the pronounced enemies of the storage battery. This fact, combined with the instances which are multiplying daily, must lead to the conviction that the storage battery has now arrived at its stage of usefulness. When such batteries have successfully withstood months of service on tramcars, according to authentic records, and when their life is being guaranteed for two years by responsible firms, the day for doubt seems to be passed. We are as yet somewhat behind in the employment of accumulators, as in England several hundred tons of battery plates, as stated in another note, were sold during the last year. These have mostly gone into use in private lighting plants where they are charged during the day time, so as to furnish current at night. But recent indications are that the secondary battery will soon enter upon a career of usefulness in this country as well.

WE publish in this issue the notice of the Executive Committee of the National Electric Light Association with regard to the Philadelphia meeting of February next. The indications are that the meeting will be a highly successful one, but there is plenty of work to be done in the matter of preliminary arrangement. The companies that are in arrears for dues can strengthen the Association very much by paying up promptly, and the local companies still unenrolled in membership cannot do better than join the ranks. The public proceedings on each occasion are extremely helpful and more than repay for attendance, while points innumerable and of lasting value to the man practically engaged in lighting can be gathered quietly in the hours out of session. Our personal observation has been that each meeting has been the means of giving the electric lighting industry a higher standing and greater influence locally and through the country. The earnestness of the speakers, the energy of the inventors with their novelties, the imposing statistics of the young but giant development, create a favorable impression, and show to all that the industry is at the furthest remove from a speculative basis, and is prospering as a solid, lasting business. These conventions not only show capital the fields that are already occupied, and therefore may well be let alone, but indicate to it the many new arenas in which it still can find profitable investment. They foster exchange of ideas and of experience, and give to each individual company a strength, influence and importance it could not enjoy standing alone. To belong to the Association is a privilege every electric lighting man should prize.

THE horse as motive power for conveyance between places widely apart long ago gave way to the steam locomotive, and it now is on the eve of retiring from street car service to make room for electric motors. Electricians have ceased to discuss the feasibility of using motors in street car traction, and the discussion has narrowed itself down to expense and various mechanical details. Every week brings tidings of some new road or the continued successful operation of others whose names are familiar. Thus on one page in to-day's issue we illustrate two roads—that at Blackpool, England, and that at Scranton, Pa. The former, started as a road with underground conductors, and presenting several new features and difficulties, has just paid 5 per cent. on its first year's work, carrying over a good balance, while it appears to have given satisfaction to all concerned. The Scranton road, just started, is using overhead conductors, and each of the cars is running 100 miles a day. The question, as we have said, resolves itself almost everywhere into one of cost. From all the information that can be gleaned on this point, the showing is remarkably favorable to electricity, which from its flexibility is suited to all the conditions of the special work. It appears that where the cable has come into competitive test with horses in large cities, that is, where each car must have from four to six teams, it has reduced expense for motive power about one-half. But it also appears very clearly that the average return of power with the cable system is only about 25 per cent., and this does not tell the whole story, for no matter how light the patronage of a road may be through stress of weather and other causes, the big cable taking so much of the power must still be pulled everlastingly around its noisy course. On the other hand, with electricity there is no motor system worth speaking of that will not give its return of from 50 to 60 per cent. of the power generated, and its return is at all times proportionate—so much work done, so much coal burned. The showing for small roads, especially where they can derive power from an electric light station already existing, is equally favorable, and on them an immense reduction is made—as at Baltimore for instance, where, with doubled speed, the cost has been cut down from $6.50 per car per day to $4; or at Detroit, where 5,500 passengers have been carried at a consumption of about 30 cents worth of screenings, or at Scranton where power for two heavy cars running each 100 miles daily is obtained, at retail, for $9 a full day. It is early yet to begin to collect statistics on this subject, and it is hardly fair to expect street railway men to tell how much it actually costs them to operate their roads; but the nearer we get to the facts and the more closely the disadvantages and inconveniences of old methods are studied, the greater become by comparison and intrinsically the merits of electric motors. The figures and details furnished in a paper appearing in our columns this week may serve, as far as they go, to direct attention to the present bearings on the subject, and to explain the confidence with which practical electricians are addressing themselves to the work.

REVIEWS OF NEW BOOKS.

Practical Dynamo Building for Amateurs. By F. W. Walker, M. E. With numerous illustrations. London: Iliffe & Son. New York: E. & F. N. Spon. Size, 7¼ × 5 in. 63 pp. Price, 80 cents.

This neat and handy little work will be found very useful by those who as students combine electrical tastes with mechanical skill, and like to construct as far as possible their own apparatus. There should be no difficulty with the use of the hints here given in building a dynamo that would run either lights or motors. It is pointed out how, with different windings, the same machine will give varying values in current and electromotive force. Generally, of course, as dynamos are now so cheap, we most of us prefer to buy them, but the mere building of such a machine would give its constructor a great many new and pregnant ideas on the subject of electricity.

Besides its practical instructions as to dynamos, the book contains some additional and useful information, in brief form, regarding secondary batteries, electroplating, electric lighting, leads and motive power. The author makes under the last head an interesting note as to wind power. He states that a year ago he saw a windmill driving a shunt-wound dynamo used for charging accumulators. An automatic cut-out was interposed to prevent the discharge of the cells through the machine during fluctuations of the wind current. There were twelve or fourteen sails with a diameter of about 7 feet, and he believes that the power developed upon the countershaft was 1½ h. p. with a moderate breeze. Many of our readers could try such a plant. Some of them in the far West might even verify an old Shakespearian quotation by getting good out of a cyclone. Or if there is a fair water supply handy, as often happens to be the case, it can be cheaply utilized for running a machine and accumulators.

Eighth Annual Meeting of the National Telephone Exchange Association. 9 in. × 5½ in. Pp. 161.

This volume of transactions, published by the Secretary of the Association, Gen. C. H. Barney, makes its appearance with praiseworthy promptitude. It contains a full report of the St. Louis meeting of September last, and therefore embraces a wide range of telephonic topics. The statistics strike us as particularly useful, and we may also mention again as deserving thoughtful consideration the discussion on long lines and tolls, and Mr. Lockwood's paper on lightning arresters. The talks on legislation and subways are also good and timely reading.

Frictional Electricity. By Thomas P. Treglohan. London: Longmans, Green & Co. 1886. 135 pp., 6¾ × 4¼ in. Paper cover. Price, 80 cents.

This little volume has been prepared as an elementary treatise on the subject, and its arrangement is such that it may be used with equal profit by both the student and by the teacher: by the former as a text-book, and by the latter as a guide to the manner in which the subject may best be presented before the class. For each of these purposes, the manner in which to make experiments to illustrate the theories and facts of the text, is added at the proper places.

Magnetism and Electricity. By H. C. Tarn. London: W. & R. Chambers. 188 pp., 6¾ × 4¼ in. Cloth. Price, 50 cents,

While this book has confessedly been written to make clear to the beginner all that is necessary for him to know in order to pass the elementary examination of the Science and Art Department, it is by no means a book giving merely facts for "cram," without logical order and connection. On the contrary, the subject is treated sequentially, and is presented in a most interesting and instructive style.

A New Source of Carbon.

The carbon employed for electrical purposes is mostly obtained from the hard deposits formed in the retorts of gas works, from coke and from natural gas; but while attempts have been made to employ the ordinary vegetable charcoal for electrical purposes, the mineral impurities in the latter have greatly restricted its use. In order to avoid the expense of grinding and manipulation of the gas retort carbon, Mr. Edgar Shaw, of Lynn, Mass., has made experiments, and claims to have discovered that by carbonizing any of the various species of marine algæ, commonly called "sea weed," a carbon product is obtained in the form of soft masses, which are capable of being readily ground or pulverized, and are free from all mineral impurities. Carbon derived from this source Mr. Shaw finds by experiment to be more suitable, especially for electrical uses, than any other carbon, while at the same time it is inexpensive to produce by reason of the vast abundance and trifling cost of the raw material and the simplicity of the treatment required to fit it for use.

In order to obtain the carbon, the algæ, or sea weed, is thoroughly washed by subjecting it to the action of hot water or steam. The material is dried, and is then carbonized by being placed in closed retorts and subjected to a high temperature for a considerable time in the usual manner. The resulting product is then treated with dilute acid and dried. It is then a perfectly pure form of carbon in soft masses or lumps, which may be easily crushed between the fingers, and after being ground can be manufactured into the various articles for which carbon is employed.

On the Predetermination of the Characteristics of Dynamos.*

BY GISBERT KAPP.

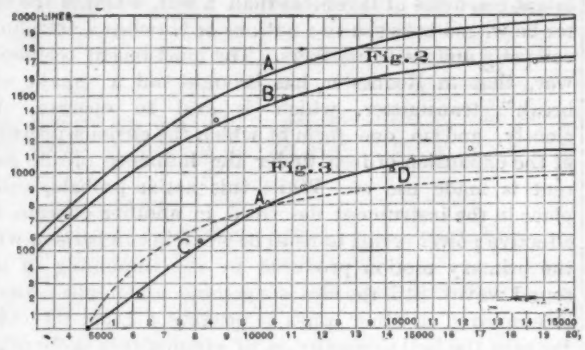
(*Concluded.*)

Whether true or not, the fact of practical importance is that we can, by the use of a tangent function determine the increase of magnetic resistance at various stages of saturation in such a way as to accord with experiment, and that therefore the same formulæ can be used for the construction of characteristics of new machines. The only data (besides those taken from the drawing) which we require to know are:

1st. Z_1, the maximum number of lines which can with an unlimited magnetizing power be forced through the armature core.

2d. Z_2, the maximum number of lines which can be similarly forced through the magnet core.

These are figures which depend on the dimensions of the cores and the quality of the iron, and if we could rely upon



Figs. 2 and 3. Ampère turns.

obtaining always the same iron, a few experiments made once for all would suffice for all future machines. Let the degree of saturation in armature and magnet be denoted respectively by σ_1 and σ_2, so that

$$\sigma_1 = \frac{z_1}{Z}$$

$$\sigma = \frac{z_2}{Z_2};$$

then the actual resistance in the armature core is obtained by multiplying the initial resistance by

$$\frac{tang.\left(\frac{\pi}{2}\sigma_1\right)}{\frac{\pi}{2}\sigma_1}$$

and similarly for the field-magnet.

From numerous experiments made with my own machines, and from data kindly supplied by some other dynamo makers, I am enabled to give the following average

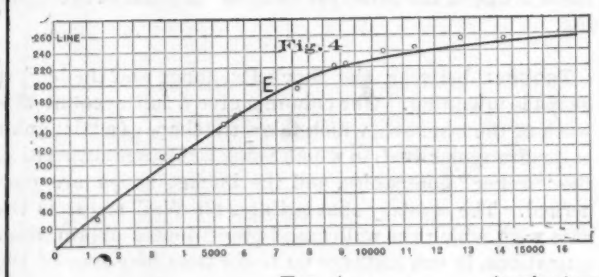


Fig. 4.

figures for the density of saturation to be taken as a basis when using my formulæ: †

	Lines per square inch.
Armatures—charcoal iron wire well annealed.....	25
" " " disc "	22
Field magnets—hammered scrap "	18

The superiority of wire over discs is possibly due to better annealing, but probably to the fact that in wire cores the lines run mostly in the direction of the fibres, while in disc cores they run as often across the fibre as with it. The inferiority of field magnet iron as compared to armature iron is probably due to the difficulty of thoroughly annealing large masses. I have no records of experiments made with machines having field-magnets composed of thin laminæ. Perhaps some of the members present can give their experience on this very important point. It will be noticed that the figures here given, although by no means the highest which can be obtained with exceptionally good iron, are considerably higher than the maximum induction obtained by the important experiments made independently by Rowland, Bosanquet and Hopkinson.

The only explanation which suggests itself to me is that the samples experimented on by those scientists were not so good as the usual commercial iron now obtainable for dynamos. Suppose, then, that we know the quality of our iron and its density of saturation. This gives us the values of Z_1 and Z_2. We now proceed as follows: We assume a certain number of useful lines (z_1), and calculate the corresponding density (σ_1) in the armature core. The corresponding value of the function tang. $\left(\frac{\pi}{2}\sigma_1\right) \Big/ \frac{\pi}{2}\sigma_1$ (taken from a table prepared beforehand) is then multiplied with the initial resistance of the armature core (R_a), and added to the air resistance. The sum is multiplied with z_1, and thus we obtain p_1, the quantity which above was called the magnetic pressure between the pole-pieces. The leakage of lines takes place under this pressure, and to obtain the exact number of the waste-lines we must know the resistance of the space surrounding the machine. This resistance cannot be calculated in the same manner as that of the air space—so much depends on the configuration of the magnets on neighboring portions of the iron bed-plate, bearings, etc.; but from the character of the resistance of a non-magnetic medium it is evident that for similar types of dynamos the value of ρ is inversely proportional to the linear dimensions of the machine. Thus this resistance can be found by dividing a constant by the diameter of the armature. An experiment made once for all is sufficient to determine this constant for all sizes of a given type. Knowing ρ, we find the waste field $\varsigma = \frac{p_1}{\rho}$, and the total number of lines created $z_2 = z_1 + \varsigma$. The ratio of z_2 to Z_2 gives us the density in the magnet σ_2, and by again referring to the table we find the corresponding value of the function, tang. $\left(\frac{\pi}{2}\sigma_2\right) \Big/ \frac{\pi}{2}\sigma_2$, with which the initial magnet resistance must be multiplied in order to obtain the actual resistance at that particular density. The product of this actual resistance with z_2 gives the exciting power (p_2) necessary for the field magnet alone, and the sum of p and p_2 is the total exciting power (P) necessary to produce z_1 useful lines. In this way we proceed to calculate P for various values of z_1, and, plotting the results in a curve, we obtain the characteristic of magnetization, by the aid of which all the working conditions of the dynamo can be found. When determining the E. M. F. of the armature while a current is passing through it, account must be taken of self-induction, which has the effect of apparently lowering the characteristic. As this action does, however, concern more particularly the armature, and not the field magnet, it does not belong to the subject of the present paper. To show the degree of approximation in calculating the exciting power in the manner above described, Figs. 2, 3 and 4 have been prepared. These diagrams contain the calculated curves for three different dynamos, while the points indicated by little circles are values obtained in actual test of these machines. The lower curve in Fig. 2 is the predetermined characteristic of one of my own dynamos. It shows the number of useful lines passing through the whole armature as a function of the exciting power. The upper curve shows the total number of lines created. The ordinates between the two curves represent, therefore, loss by leakage. In order to enable anybody to check the correctness of these and other curves, the data on which they have been obtained are given in the table below. The experimental points shown by little circles have for this dynamo the following values:

z_1 =	715	1,330	1,490	1,705
P =	3,800	8,600	10,800	18,600

By the courtesy of Messrs. Paterson & Cooper and Messrs. Crompton & Co. I have been able to test these formulæ on their machines, and the result is given in Figs. 3 and 4 respectively. The curves shown in full lines are predetermined characteristics showing the number of useful lines flowing through one-half of the armature. (These machines, "Phœnix" and "Crompton," are of the double magnet type.) The experimental points in Fig. 3, which were kindly supplied to me by Mr. Esson have the following values:

$\frac{z_1}{2}$ =	207.5	594	792	910	1,030	1,070	1,130
P =	1,604	3,840	5,660	6,900	9,620	11,240	12,100

For purposes of comparison, a curve obtained by Frölich's formula has been added. This dotted curve shows values of

$$\frac{z_1}{2}$$

obtained by using the function

$$\frac{P}{\alpha + \beta P},$$

where α and β are constants which can be determined if two points of the actual characteristic are known. By choosing these two points near to each other a fair degree of approximation between the actual characteristic and Frölich's curve can be obtained, but only on that portion of the curve which lies between the points. Beyond it, on either side, the divergence is considerable. If one of the points is at $P = \alpha$ (which would give, according to Frölich's new notation, the value of S as the reciprocal of the maximum magnetization), the curve ought to be available from the chosen finite point up to saturation. In the diagram the finite point has been chosen at A, where P = 5,500, or about half the maximum exciting power which would be commercially profitable with this machine, since a larger power than 11,000 ampère turns would not produce any material increase of E.M.F. From the tendency of the characteristic, saturation has been assumed at $\frac{z_1}{2}$ = 1,150. This gives $\beta = \frac{1}{1150}$ and $\alpha = 2.32$. The dotted curve is found by using

* A paper read before the Society of Telegraph Engineers and Electricians.

† These figures are not to be taken as generally applicable, but simply as *averages* of the usual qualities of iron now obtainable.

these values, and shows a considerable deviation from the points determined by experiment. By choosing the finite point *A* higher up the actual characteristic, a somewhat better accord between the latter and Frölich's curve could be obtained, but at the same time the range over which that curve can be used would be shortened.

As regards the curve of the Crompton machine (Fig. 4), the experimental points were kindly supplied to me by Mr. Swinburne, and have the following values :

$$\frac{z_1}{2} = \quad 27 \quad 112 \quad 151 \quad 161 \quad 197 \quad 223 \quad 221 \quad 240 \quad 246 \quad 258 \quad 258$$

$$P = 1{,}400 \cdot \left\{ \begin{matrix} 3{,}300 \\ \text{and} \\ 3{,}800 \end{matrix} \right\} \quad 5{,}300 \quad 5{,}700 \quad 7{,}700 \quad 8{,}820 \quad 9{,}050 \quad 10{,}420 \quad 11{,}300 \quad 12{,}900 \quad 14{,}060$$

The curves were formed by using the following data :

Table of Constants for the Three Dynamos Investigated.

Fig.	Z_1	Z_2	R_α	Ra	Rf	ρ
2	2,200	2,200	3.7	0.40	1.18	30
3	1,200	1,940	4.7	0.57	0.925	18
4	300	460	2.8	1.00	2.77	47

In the discussion which followed the reading of the paper Mr. Mordey inquired whether the magnetic effect of the current in the coils of the armature ought not to be taken into consideration in determining the magnetic resistance of the armature core. The current tended to a certain extent to polarize the core in a reverse direction to that of the field-magnets, hence an apparent reduction of magnetic resistance might be expected to ensue. Thus another reason existed for making the cross section of the field-magnets greater than that of the iron in the core, in addition to that pointed out by Mr. Kapp.

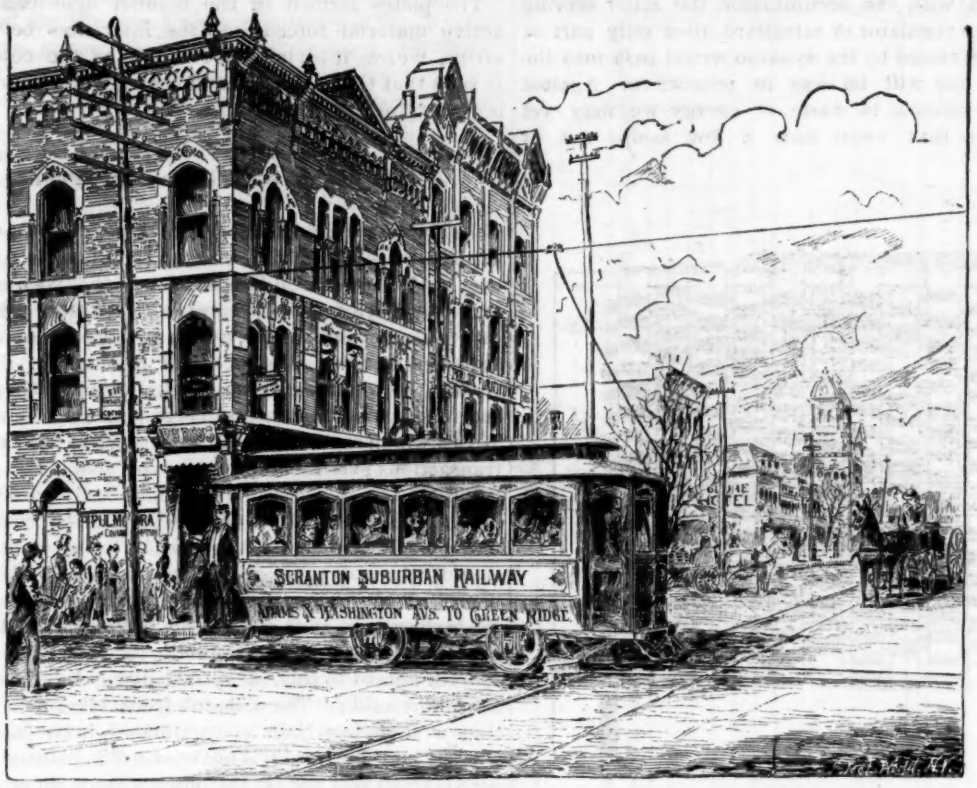
Mr. Fricker inquired whether the specification of the magnetic induction of a given current in a coil ought not to be expressed in "ampère feet" rather than by "ampère turns."

Mr. Crompton said that while it remained a regrettable circumstance that more practical experience was being gained in other countries, yet he felt proud of the fact that it was in England the fundamental work both in theory and in practice had been accomplished—a work which rendered it possible for others to obtain advantages which for the present were denied themselves. Mr. Crompton then referred to M. Deprez, and with reference to his recent claim to have originated the short, thick, field-magnet, said that he was confident that this claim could not be substantiated. Neither did he think that M. Deprez had in reality been the first to use the "characteristic curve," of which Dr. Hopkinson was undoubtedly the originator. Mr. Crompton thought that the progress which had been made in the construction of dynamos during the last four years could only be considered highly satisfactory, in the light of the fact that during that period the cost of manufacture had been reduced to little more than one-fourth for machines of the same output.

Mr. Alexander Siemens pointed out the desirability of not running dynamos up to their maximum capacity. A factor of safety was always taken in other machinery, and a similar rule should be observed in regard to dynamos.

Mr. Swinburne said that the principal difficulty in the application of the formulæ, both of Mr. Kapp and of Dr. Hopkinson, arose from the necessity of determining the relative magnetic resistance of the air, which was by no means an easy matter. Mr. Swinburne then pointed out further reasons for believing that Prof. Rowland's formula of magnetic induction was inaccurate. If it had been true it would have been impossible to build a self-exciting shunt wound machine. Mr. Kapp had said that machines with too little iron could not be compounded. On the contrary, a machine with its field section little more than its armature section is very easy to compound. With regard to laminated field-magnets, it was true that Messrs. Crompton & Co. employed bar iron for their field-magnets, not, however, with the idea of avoiding Foucault currents, which in a properly-built machine were negligible in the field, but simply from the facility of construction which the use of bar iron afforded.

Mr Esson said it would be useful to have data as to the comparative advantage of armatures having cores composed of discs and of wire, other things being equal. Referring to the necessity for making the cross section of the field-magnets greater than that of the armature cores, he would also like to inquire what should be the exact ratio between these quantities. Great divergence existed among different makers in this respect. In the Mather and Platt machines and in the earlier Phœnix machine the cross-sectional area of armature core is to that of the field-magnets as 2 to 3 ; in Messrs. Crompton's machines and in Mr. Kapp's the ratio is 1 to 2 ; in Goolden and Trotter's and some others it is as high as 1 to 1. There must, however, be some point of maximum economy. He had recently made an experiment in which, by doubling the quantity of iron in the armature, the number of lines passing through it had been increased 90 per cent. Since then he had been reducing the relative section of the field-magnets with advantage. The present practice in the Phœnix machine was to employ the ratio 3 to 4, but he could not say whether they should not still further increase the ratio.



THE VAN DEPOELE ELECTRIC RAILWAY, SCRANTON, PA.

The Scranton Electric Railway.

In our last issue we gave an account at some length of the opening of the new Van Depoele electric railway at Scranton, Pa. The road started under the most unfavorable conditions, there being as much as six inches of snow, ice and slush on many parts of the track, but it appears to be giving great satisfaction to all concerned. A speed of 12 miles an hour is attained, and the motion of the car is very smooth and easy. We give on this page a view of one of the cars on the track. Each of the cars is now running over 100 miles daily.

The Next Meeting of the National Electric Light Association.

We are in receipt of the following from Mr. A. J. De Camp, the chairman of the executive committee of the association :

Extensive preparations are now being made for the entertainment of the members of the National Electric Light Association which meets in Philadelphia in February.

The date and place will be determined by the executive committee, which meets in Philadelphia at the Hotel Lafayette, Dec. 21, at 3 o'clock P. M.

It is designed to make the meeting in February the most interesting yet held by the association. It is unfortunate, however, that out of the two hundred companies represented in the association, eighty-five are in arrears for dues for the year 1886. Duplicate bills are now being sent to delinquent members and it is hoped the officers of the association will not be embarrassed for the want of funds.

The Executive Committee hope to effect an arrangement with the Hotel Lafayette—the most popular and centrally located hotel in Philadelphia—for entertaining the members in February.

The Julien Car at the Paris Exhibition.

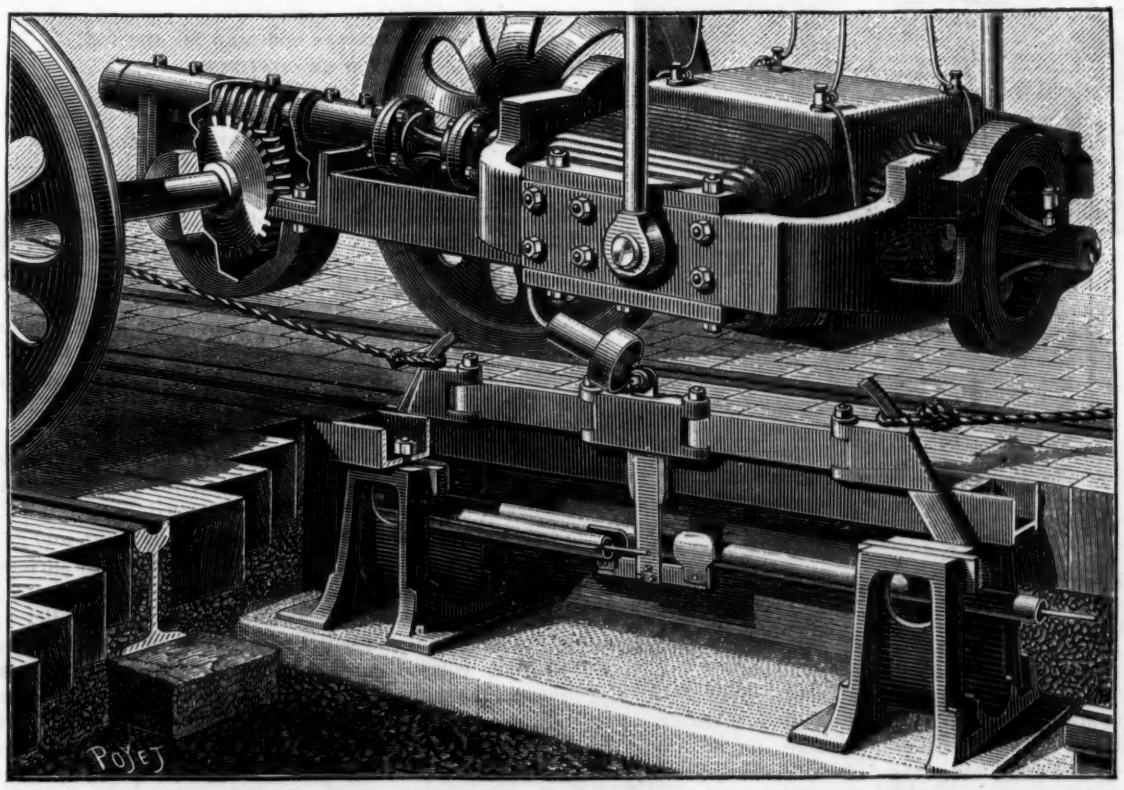
We have already made mention of the fact that a tram-car on the Julien storage system has been in operation at the Exhibition of the Palais de l'Industrie, at Paris, where it ran from July 1, the opening of the exhibition, to its close on November 30. During that time the car was subjected to a continued test by a committee consisting of the following well-known gentlemen : H. Fontaine, M. Lemonnier, E. Hospitalier, D. Napoli, M. Monnier, M. Jarriant, G. Trouvé, H. Vivarez, J. Carpentier.

A cablegram from Paris now announces that the jury has awarded M. Julien two diplomas of honor; one for the accumulators, and the other for his system of traction.

The results obtained by the committee were even more favorable than those arrived at in the tests made at the Antwerp Exhibition. It was for the purpose of confirming the results arrived at in the former instance that M. Julien entered his cars for test at Paris.

The Blackpool Electric Railway.

This road, which was the first in England constructed on the conduit system and operated by it for commercial purposes, attracts attention not only on account of its mechanical features, but also from its financial success.



VIEW OF MOTOR AND TRACK, BLACKPOOL, ENG., ELECTRIC RAILWAY.

The main features of the car and road-way have already been described in THE ELECTRICAL WORLD, but the sectional perspective given by our esteemed contemporary *La Nature* shows the arrangement as a whole so admirably that we reproduce it for the benefit of our readers. The manner of suspension of the motor from the car and the method of making contact are shown so clearly that no further explanation is necessary.

It is interesting to note that the result of one year's operation has justified the declaration of a five per cent. dividend. The total working expenses were $16,500, and the total revenue $25,500, leaving a balance of $9,000. Of this amount, $5,000 was declared as a dividend on $100,000, the capital of the company, and the remainder carried to the reserve fund and balance account.

Practical Notes Concerning the Construction, Use and Management of Storage Batteries.

BY A. RECKENZAUN.

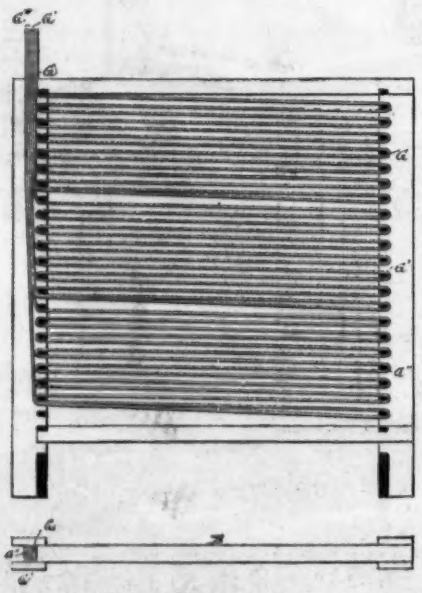
There are at the present moment indications which tend to give one the idea that the manufacture of storage batteries is fast developing into a great industry, and if the existing rate of advance is maintained, we may expect that this new industry will soon become one of national importance. England is now the only country in which secondary batteries are produced on a sound commercial basis, and the progress which has been made is in a great measure due to large pecuniary sacrifices during the early stages of development. By small and apparently insignificant steps, and with great efforts and much unnecessary labor, have these batteries been brought to a certain state of perfection, and there can be no doubt that further improvements will yet be brought about; but such improvements will be sought in the direction of increased durability and reduction in cost of manufacture.

The premature confidence reposed in secondary batteries was long ago destroyed by early failures. Successes during the last two years, however, have had the effect of partially re-establishing confidence, and we may regard it as a happy incident that a reaction did not set in suddenly, for in that case there would have been a rush for the article, and in the attempt to satisfy too great a demand, without the requisite means of supply, inferior articles would probably have found a market.

How far the storage battery has re-established itself in public favor may be gathered from the fact that some £60,000 worth of storage batteries have been legitimately ordered and sold during the past twelve months. This represents in the aggregate about 1,000 tons of cells. This amount has been furnished by two or three firms in this country. We take no account of the tons of storage batteries which have not an established reputation, but which may have found purchasers, and others that may still pine in "purgatory."

The importance and desirability of an economical and practical secondary battery has been fully recognized by all who have considered the subject, and it is generally accepted that though there is a considerable amount of loss in the conversion of energy, the undeniable convenience of a method of electrical storage greatly compensates for the attendant waste. Besides the loss of energy there are two other objections to the employment of storage batteries, and these are first cost and depreciation. How far these objections may be justified, how far they have been removed, and in what direction they may be still further eliminated, will be the theme of these notes.

Loss of Energy.—It was generally assumed, in times when dynamo machines gave an efficiency of only 70 per cent., that the losses between the shaft of the prime mover and the terminals of the battery amounted to about 50 per cent. of the available power; modern dynamos, however,



FIGS. 1 AND 2.—NOVEL FORM OF SECONDARY BATTERY.

have an efficiency of 85 and some even 90 per cent. But in the application of the accumulator as an auxiliary to an installation, we have neither to blame nor to credit the cells with the goodness or the defects of the dynamo; and makers of dynamos would at once inform us that the secondary battery has to stand on its own merits. The efficiency, therefore, of the storage apparatus is a fraction of the total energy supplied to it by the electric generator, and this fraction amounts to not less than $\frac{7}{10}$, or 70 per cent.; in other words, for every 100 watts sent through the cells, 70 watts at least reappear as useful work.

Let us express this loss in terms of pence, or a fraction thereof, assuming the source of energy to be coal at 20s. a ton converted into mechanical energy through a steam boiler and engine, consuming fuel at the rate of 5 lbs. per horse-power per hour. In round numbers, the cost of coal will come to one half-penny, and since the steam horse-power has been found to yield sufficient energy through the medium of a dynamo to keep eight lamps of 20 candle-power incandescent, the light per lamp hour, as far as coal is concerned, will cost one-sixteenth of a penny.

Through the intervention of the storage battery, then, the cost per lamp per hour, in fuel, is raised to nearly one-eleventh of a penny. There is, of course, also more water used and a greater wear and tear of machinery if the plant is working 10 hours for charging, and the accumulators alone are to supply light during seven hours without the engine. It is, however, seldom arranged that the engine is to stand idle while the maximum number of lights is required, and when the charging machinery is working in conjunction with the accumulator, the latter serving principally as a regulator or safeguard, then only part of the current generated by the dynamo would pass into the cells and the loss will be less in proportion. Against the objection relating to waste of energy we may yet place the fact that when only a few lamps out of

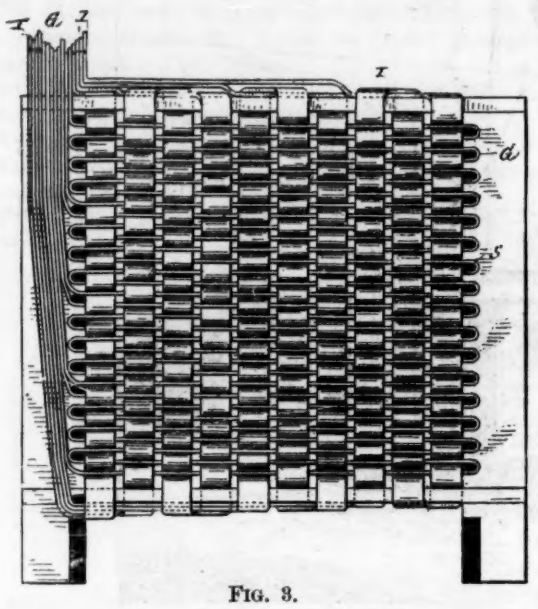


FIG. 3.

many are required to be alight, as would frequently be the case in most installations, we need not work the engine and dynamo, the wear and tear of which, as well as cost of attendance, is practically the same whether five lamps are in use or as many hundred. Moreover, if the consumption of fuel constituted the major part of the cost of electric lighting, then with the above figures before us we may still stay to consider whether it would be wise to adopt the storage system, but we know that the cost of coal in large installations is less, and in medium sized and small installations much less than one-half of the total outlay, hence the apparently big waste of 30 per cent. of the available power will appear small in comparison with the sum of items involved in electric lighting, when on an average we may take the value of a lamp hour at one half-penny, or between five and six times the cost of the fuel at the comparatively extravagant rate of 5 pounds per horse-power hour and 20s. the ton.

(TO BE CONTINUED.)

A Novel Form of Storage Battery.

With the object of overcoming the difficulties encountered in the older forms of storage battery, such as the buckling of the plates, and the falling out of the active material, Mr. Charles Sorley, of this city, has devised a form in which these objections are said to be effectually overcome. By the same method, the insulation of the strip, due to disintegration, or the deposit of sulphate of lead between the metal and the active material, is claimed to be avoided.

One form of the cell is shown in Figs. 1 and 2, which exhibits the strips of lead wound over hard rubber supports at the sides. Commencing at *G*, at the upper left-hand corner of the frame, the strip is carried under the first rung, then across the frame to the second rung, and so on down the frame until about one-third of its surface is covered. The end of the strip is then carried upward on the left-hand side of the frame and arranged parallel with the other end of the same strip. Starting at *G'*, a second strip is carried downward under the eighth rung, across the frame, and so on down, and until another third of the surface of the plate is covered, the end being carried upward and arranged parallel with its other end and the ends of the strip *G*. A third strip *G''* is carried downward and over the last third of the surface of the plate, and then upward and along the side of the other strips. The ends of the strips *G*, *G'* and *G''* when united form the terminal.

By thus winding the lead strips the conductivity of the battery is increased in proportion to the number of separate strips employed, and the capacity for rapid charging is said to become very much greater, while, at the same time, it can be discharged without giving rise to a dangerous amount of heat.

In another form of cell shown in plan, section and end view in Figs. 3, 4 and 5, the vertically arranged strips of lead are wound in and out or turned over the horizontally-arranged strips so as to cover the entire surface of the plate. In the sectional view, Fig. 4, *G* represents the horizontally-arranged strips, and *I* the vertically-arranged strips. The strips *I* and *G* have their broad surfaces in contact, and the strips *I*, in passing over the strips *G*, form receptacles *S*, alternating in position on opposite sides of the plate.

In both forms of cell the arrangement of the supporting frame is such that the body of the plate is raised above the bottom of the containing cell. This is done for the reason that, if any material should separate from the plates it drops to the bottom and prevents the short-circuiting of the plates.

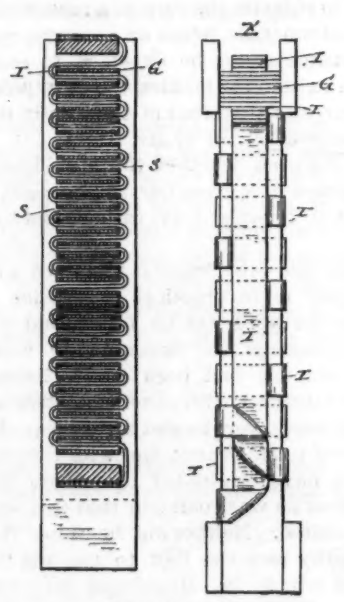
The plates formed in the manner described have the active material forced into the interstices between the strips, which, it is claimed, retain it, as the construction is such that the expansion and contraction occurring during charging are provided for.

A Rumored Telegraphic "Pool."

Telegraph circles and Wall street have been actively engaged the last week in discussing reports as to a combination "pool" or consolidation between the Western Union and Baltimore & Ohio telegraph companies. The rumor has taken various shapes, and is in more than one quarter supposed to have substance and foundation. Early last week, the Southern industrial journal, *Dixie*, had a special dispatch from a staff correspondent at Fort Worth, Texas, which says: "One of the largest and most important transactions ever recorded is now on foot. It is nothing less than a trade between Jay Gould and President Garrett, of the Baltimore & Ohio, whereby the entire Baltimore & Ohio telegraph system is to be transferred to Gould, who now practically owns the Western Union. In return for the same President Garrett is to receive the Wabash system, thus giving the Baltimore & Ohio a line to Kansas City from Baltimore."

With regard to this, a special dispatch of Dec. 8 from Baltimore said: "The dispatch from Atlanta to the effect that a trade has been consummated between President Garrett and Jay Gould, is not credited in Baltimore. President Garrett was not at his office when a reporter called. Dr. W. T. Barnard, assistant to President Garrett and Chairman of the Executive Committee of the Baltimore & Ohio Telegraph Company, was told about the dispatch. He was about to answer the reporter's question, but paused and said: 'No; I will not make any reply. Simply say that you told me about the dispatch and that I laughed you out of the office.' Mr. Garrett's address to the Directors to-day, upon his re-election as President, is of an independent tenor and does not indicate any such bargain as the Atlanta dispatch reports."

General Superintendent Robert C. Clowry, of the Western Union Telegraph Company, said on Dec. 9 that there was no reasonable probability of the report of the combination of the Baltimore & Ohio with the Western Union being correct. He had not seen the latest reports in reference to it, but knew that former rumors had been most emphatically denied by official authority. Even now the Western Union is lowering its rates West, in Nebraska,



FIGS. 4 AND 5.

Kansas, Colorado, Utah and elsewhere, as rapidly as is consistent with its ability to do so, and this is being done in many places where there is no competition at present or likely to be in the near future. The company is pursuing a policy of its own in this regard, encouraging thereby the further growth of business, by the adoption of rates that can by no means be correctly held as prohibitive. Whatever stock jobbers might report to aid the present bull movement in the East, by the circulation of rumors of a combination with, or absorption of, the Baltimore & Ohio, he felt free to say that the Western Union management would not change its policy, and needed no alliance for self protection.

Mr. Gould is also said to have denied the truth of the reports. As bearing directly on the subject, the following special from Pittsburgh, of Dec. 9, has importance:

A few days ago C. A. Tinker, General Superintendent, and Charles O. Rowe, Division Superintendent, of the Western Union Telegraph Company, paid a quiet visit to this city, and made a thorough inspection of the Baltimore & Ohio Telegraph office. About the same time

General Thomas T. Eckert and other high officials made a similar inspection of the general offices of the Baltimore & Ohio at Baltimore. These movements occasioned considerable talk in telegraph circles here, but their full significance was not revealed until this evening, when the statement was made, by several persons who professed to have derived the information from official sources, that the two telegraph conpanies have perfected arrangements whereby they will hereafter work in harmony. Manager Clark, of the Western Union, was asked to verify or contradict the statement, when he said he knew that negotiations of some kind had been in progress for some time, but he did not know what they had reference to. An official of the Baltimore & Ohio said:

There is good foundation for the report. A consolidation does not necessarily mean that the Baltimore & Ohio offices will be closed. Offices of lines purchased by the Western Union have generally been kept open; but, if I mistake not, on the first of January the rates at all offices of the Western Union and Baltimore & Ohio where there is competition now will be advanced. It will boom stocks in both companies, and this is, no doubt, one of the objects of the move. They will then both join in fighting the Postal and other independent companies at all competing points, making rates lower than any that now exist, and still have larger earnings, because the Baltimore & Ohio can advance rates in a dozen places where it will reduce in one.

It should be added, as offsetting much of the talk, that Mr. N. C. Griswold, Assistant Superintendent for the Baltimore & Ohio at Pittsburgh, speaking on the subject to a reporter said: "My attention has been called to the publication of articles indicating that the Baltimore & Ohio Telegraph Company would, in the near future, be absorbed by the Western Union Telegraph Company. Much significance is therein given to a visit made to my office by Messrs. Tinker and Rowe of the Western Union Company. These gentlemen called upon me as a representative of the Baltimore & Ohio Railroad Company in connection with certain matters appertaining to a contract which the Western Union claims to have with the Pittsburgh & Connellsville Railroad. The rumors are absolutely false. The Baltimore & Ohio Telegraph Company have to-day made a still further reduction in rates, which is of itself an unanswerable refutation of the stories of its absorption."

Apparatus for Indicating the Charge of Storage Batteries.

Where storage batteries are employed, whether for lighting or for power purposes, it is desirable to have a ready means of knowing the exact amount of energy stored after use, and, on the other hand, to have an indication of the progress of charging, so that the latter operation may be stopped at the right time. Such an apparatus has been devised by M. de Montaud, in France, to be used in connection with his storage batteries. As one form of the apparatus is quite simple, and seems to be of utility, we will describe it.

The main feature of the register, shown in Fig. 1, consists of Marcel Deprez's "fish-bone galvanometer," which is so well known that no description is necessary. The needle of the instrument carries a pointer having a marking point at its end bearing against a roll of paper which is continually drawn through rollers by clock-work at a definite rate. From the dial of the galvanometer there extends another arm which traces a continuous zero line, so that the strength of the current, at any point on the paper, can be read off by merely comparing it with the zero line.

It is evident that the extent both of the charge and discharge of the batteries can be registered in this manner. Our illustrations, Figs. 2 and 3, show a specimen of the cards obtained. It will be apparent that instead of a continuous roll of paper a single card fixed to a revolving cylinder will answer the purpose.

The cylinder may be revolved at any convenient rate and the cross-lines on the paper show the correct intervals of time; while the line traced by the galvanometer pointer shows the amount of current passed into, or out of the batteries at every instant. In this way a glance at the cards will show the exact condition of the cells.

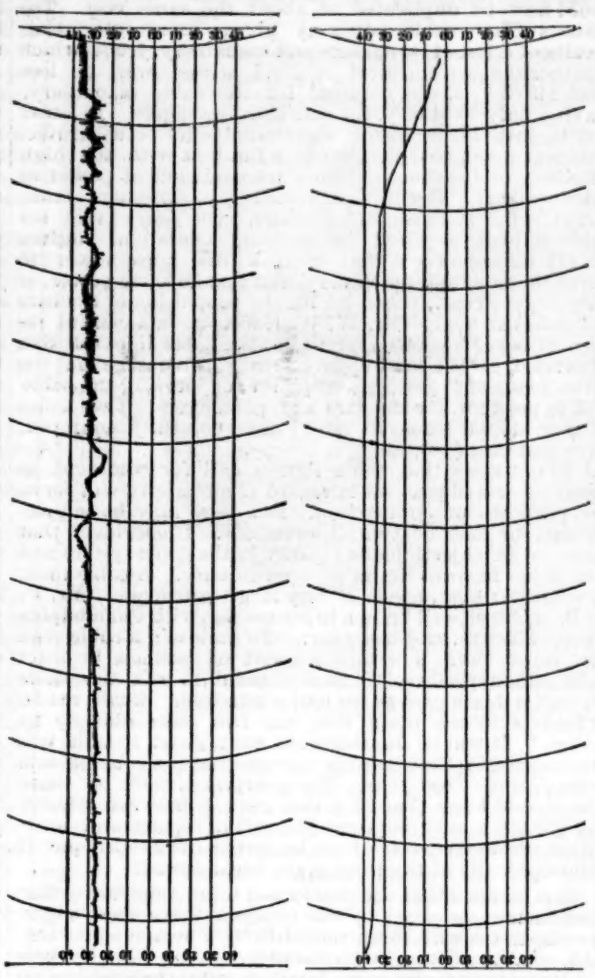


FIG. 2. DIAGRAM OF CHARGING.

FIG. 3. DIAGRAM OF DISCHARGE.

In another form of register devised by M. de Montaud, which, though ingenious, would hardly seem to be practical on a large scale, the principle employed is that of the change in weight of the plates produced by the charge and discharge of the cells.

During the charging of the cell peroxide of lead is formed at the positive plate and reduced at the negative, while at the same time, according to M. de Montaud, desulphatation of the positive and negative takes place with the liberation of sulphuric acid. The plates therefore lose weight. He utilizes this property by suspending the plates in the solution at one end of a balance lever and weighing the loss. The illustration, Fig. 4, shows the apparatus in perspective. According to Dr. d'Arsonval, one ampère hour stored liberates 3.73 grammes of sulphuric acid; whence it follows that an accumulator which has been charged for 100 ampère-hours has lost 373 grammes in weight (of plates). During the discharge the reverse action takes place and the plates gain in weight.

The register consists of a revolving barrel upon which a sheet of paper is mounted and the divisions of which indicate certain intervals of time, such as an hour. The pointer marking on the paper is connected with the balance and is so arranged that an increase or decrease in weight of 3.73 grammes raises and lowers respectively the marking point 1 mm., so that a continuous register of the quantity of current charge is obtained.

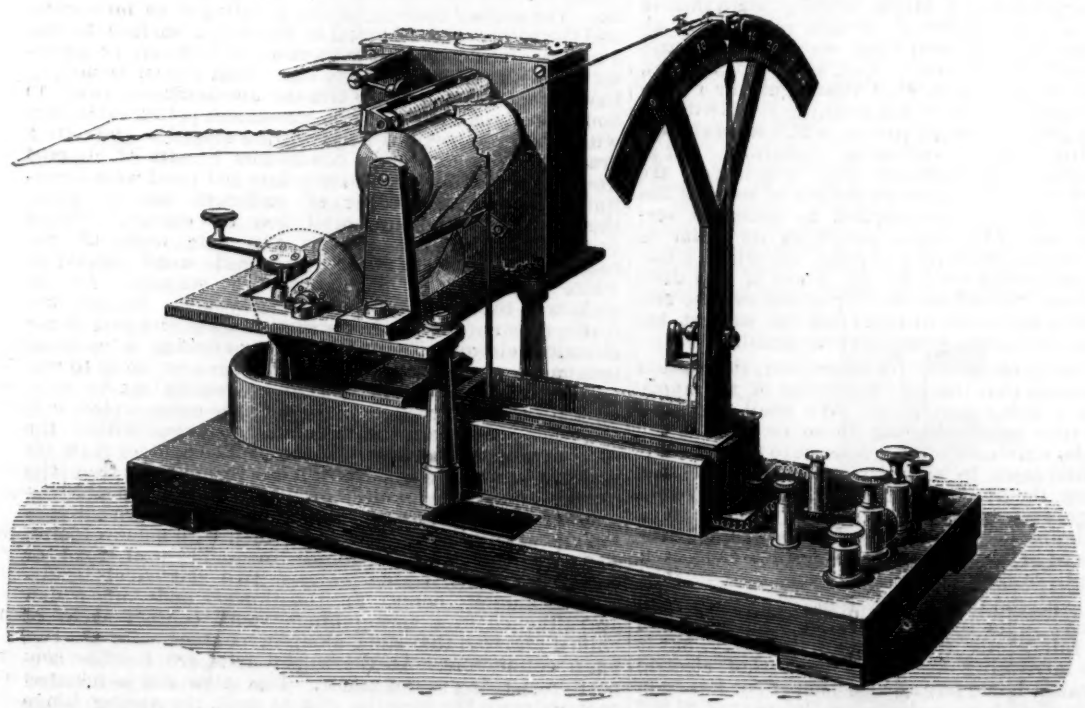


FIG. 1. REGISTER FOR STORAGE BATTERIES.

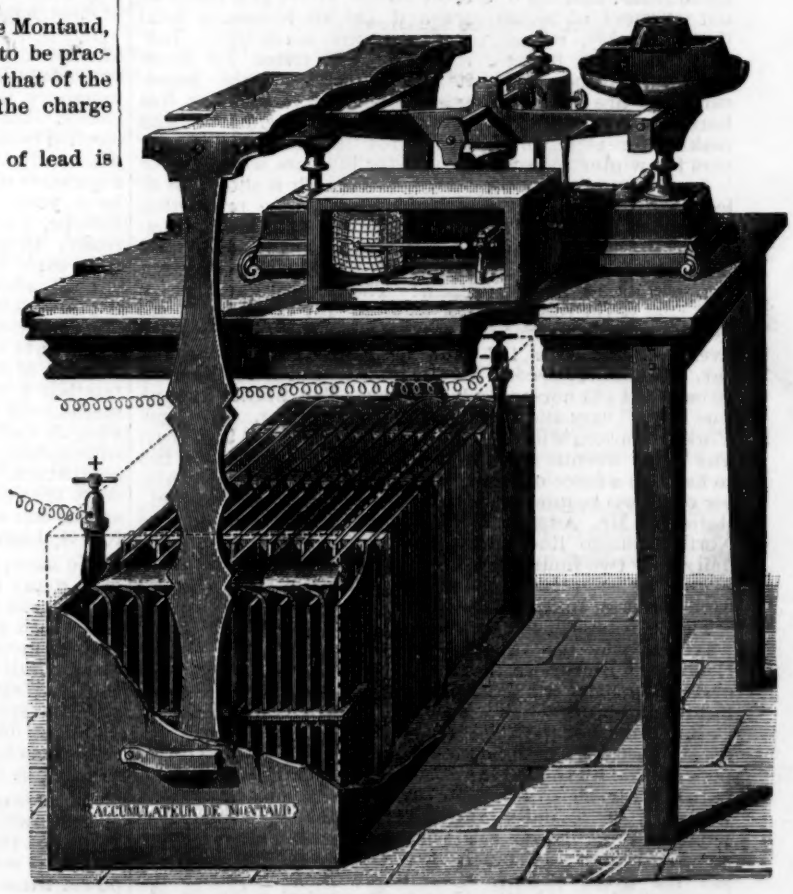


FIG. 4.

Effect of Electric Light on Plant-Growth.

In a communication to *Science*, Mr. Chas. E. Putnam, of Davenport, Ia., writes:

"The light from an electric-lamp tower in Davenport, Ia., falls full upon a flower garden about one hundred feet away; and during the past summer the owner has observed that lilies which have usually bloomed only in the day have opened in the night, and that morning-glories have unclosed their blossoms as soon as the electric light fell on them."

The above item, which originally appeared in the *Democrat* of this city, and has gone the rounds of the press, has a substantial basis of fact. The "Jenney" system of electric lighting was introduced into this city early this past spring, and across the street from the residence of Mr. Henry W. Kerker is situated one of its towers. This tower is 125 feet high, and contains five arc lights, each of 2,000 candle-power. During the past summer, Mr. Kerker's attention was attracted to the singular effect these lights produced upon some day-lilies blooming in his garden. These flowers closed as night came on, but, as soon as the electric lamps were started up, they re-opened, and while the lights were in operation continued in full bloom. As the street is about 80 feet wide, the lights were distant some 200 feet from the flowers. Other similar observations here are reported, but, as they are less accurately verified, I pass them for the present without special mention.

The Pacific Cable Scheme.

With regard to the scheme for putting down a Canada-Pacific Cable, a special dispatch from Montreal of Dec. 9 says:

Within the past month immense strides have been made toward the realization of a Pacific cable scheme, and there is now every prospect that it will be an accomplished fact at an early date. Mr. Sandford Fleming, speaking of the matter this morning, said that the company had been formed under the name and title of the Pacific Telegraphic Company, Limited, with a capital of £2,000,000 in £10 shares, for the purpose of establishing, maintaining and working telegraphic and other communications between Australia, New Zealand and other islands in the Pacific Ocean, and also with Africa and America. The articles of incorporation were registered in London within the present month. The company, which is composed as follows, is a strong one: Lord Miltown, Sir J. P. Covey, member of Parliament; Sir Daniel Cooper, Baronet; Lord Folkstone, Mr. Hugh G. Reid, Sir Alfred Slade, Baronet; J. H. Heaton, member of Parliament; the Hon. E. M. Young, Sir Donald A. Smith, Mr. Sandford Fleming, Sir Samuel Wilson, Mr. E. G. Finch Hutton, Capt. Edward Palliser, Mr. Randolph C. Want, Sir W. J. Clark, P. Perkins and Sir George Coote. A subsidy of £50,000 per annum is expected from the Home Government, while it is anticipated that the various colonies will co-operate.

Electric Street Cars.*

BY T. C. MARTIN.

The great question agitating street railway companies in this country at the present time is the use of some motive agency more economical and convenient than horses. It is no exaggeration to say that after about half a century of patient trial they have become profoundly dissatisfied with animal power and are ready to adopt any system that can establish its claim to their preference. Evidence of their feeling on the subject is seen in the fact that at the last convention of street railway men, the progress of electric motors was reported upon by a special committee whose optimistic statements were heard with pleasure. One of the most prominent members avowed that he regarded the promise of electricity as a motor with which to supersede horses as very encouraging. Another said: "All honor to those who are giving an hour or a dollar to the development of this important agent." A third thought it the duty of the convention to extend an earnest and cordial greeting to every man who was "trying to replace bad with good." These sentiments should, I think, encourage us, who with enthusiastic pride have seen the rapid increase in efficiency of the electric motor, and who, no matter what may be our predilection for particular systems, assert and know that—as a bottom and basic principle from which to start—electricity is more than equal to all the demands that may be made upon it in the special service of propelling street cars.

The struggle for supremacy in this field of occupation may fairly be said to have narrowed itself down to three competitors—the horse, the cable, and the electric motor. Steam used directly is, it seems to me, viewed with more and more disfavor as the years go by, and has within city limits come to be considered very much in the light of a nuisance. The lowest cost of operation per steam motor per day, in usual service, that I have seen quoted authoritatively is $8.50 and $7. But even if steam were cheap, there are grave objections on the score of noise, smell and dirt. The mere fact that steam locomotives have been in successful use 50 years but are still denied employment on the streets, tells its own story as to public opinion. To some of us the banishment of steam even from the tracks of elevated roads seems a matter of but a few years. As for gas, soda and compressed air motors, I am not aware that they offer any points of superiority over steam for the specific purpose under discussion.

Coming to horses, we find that in spite of their universal use and their faithful performance of duty, they inspire a discontent anything but complimentary, yet hardly to be wondered at. The statistics of horse cars are important and interesting, and deserve our attention as covering the sphere within which the electric motor will operate. There are, according to the latest returns available for this year, about 625 street railways of all kinds in the United States and Canada. Taking of these 408 horse roads giving full and trustworthy figures, I find that they run 17,331 cars and employ 85,888 horses. If at the same ratio we took all the horse roads, upward of 500, we should arrive at a result of not far short of 25,000 cars and 120,000 horses, a total that probably comes very near the actuality. Taking the other figures, which I have tested by three sources of information, it appears that all the horse-car lines are maintaining a proportion of at least five horses to each car. But that is inclusive, and making a reasonable allowance for the use of different cars for winter and summer, and for idle cars, as well as for "doubling-up" in heavy snows, a result is shown of at least eight to ten horses per car. This is the proportion usually cited, and it is brought out on a special examination of the statistics for this city. Thus the Broadway and Seventh avenue road has 121 cars and 1,350 horses, or not far short of 12 horses per car. The Central Park, North and East River road, with a total of 161 cars, has 1,223 horses, a broad average of 8 horses per car. The Eighth avenue road, with 112 cars, has 1,155 horses, or 10 per car. The Forty-second street and Grand street line has 50 cars and 485 horses, or 9 per car. The Sixth Avenue line has 127 cars and 1,296 horses, or 10 per car. The New York & Harlem with 164 cars has 1,321 horses, or 9 per car. The Third avenue road, returning a total of 360 cars, has to keep up a force of nearly 2,200 horses. The large number of horses required is also to be learned from the fact, stated by Mr. Augustine W. Wright, that those on the North Chicago line, which is a favorable sample, work daily only two hours and seventeen minutes. Or to put it in another way, the 6,158 street car horses of Boston travel each about 10 miles a day only, or two hours' service.

The costliness of horses may be arrived at in yet other ways, by the use of comparative figures. Mr. T. C. Robbins, of Baltimore, a street car expert, gives the average cost of horse car per day at $6.50. I have had the same figures given me for Brooklyn and Philadelphia, while Mr. C. B. Holmes, of the Chicago Cable Railway, who has had great experience with horse service, says that the expense per car-mile by the cable system is 10 to 11 cents, as compared with 20 to 25 cents per mile when employing horses. On a daily run per car of 50 miles, that would be at least $12 per day with horse traction, and half as much for cable. Moreover, there are the great extent of valuable land required for huge stables and the heavy depreciation of stock. Few occupations are more exhausting to horses than street car traction, and the average railroad life of a horse is but from three to five years. In other words, out of 100,000 horses, at least 20,000 every year die or become useless for their work and drag out the remainder of their existence in other occupations. "How are you getting along with those old horses I sold you," said the street railway president to Mr. Sexton, the undertaker. "Pretty well," was the reply, "I tried 'em first in the mourning coaches, but they were too slow for the ladies. Then I put 'em in the hearses, and I haven't heard any complaints from that quarter."

The cable has already made its way into use on a large number of street railways doing a heavy business, and is, it must frankly be admitted, a vast improvement on old methods. It has enabled those roads to handle a traffic that was utterly beyond their capacity before. It has accelerated speed, has lessened accidents, has given the streets a cleaner look, has, it would seem, cut down expense, and has certainly raised the value of property wherever put in. But I doubt seriously whether in view of the enormous first cost of the cable system and the excessive waste of power, it will make very rapid strides, especially when subjected to the rivalry of electric motors. At the recent street car convention, the new cable roads at Kansas City were presented for favorable notice, and as they were evidently considered good specimens, let us accept the figures. The Metropolitan road will cost $50,000 per mile of single track, and I observe that it is claimed with regard to the Philadelphia system that the track there could now be duplicated at about the same cost. The Kansas City cable company gives some interesting results of a test of its engines and machinery, from which I gather that with a total of 159.7 horse-power, no less than 119.06 h. p. was required for the cable machinery, leaving only 40.64 h. p. for cars and passengers. In other words, just 25 per cent. was available for actual traffic. This waste will strike electricians familiar with the high efficiency of dynamos and their transmission of power as extraordinary. But it is confirmed by a statement from Mr. C. B. Holmes, of Chicago, who says that his cable railway required for ordinary operation engines of 477 horse-power; that it took 389 horse-power to move the cable and machinery, and that 88 horse-power, or only 18½ per cent., was used for the propulsion of the cars at 9 miles an hour. Mr. W. W. Hanscom, in a careful review of the conditions applying to the cable lines of San Francisco, gives a total daily average percentage on the seven roads of 68 per cent. of power for moving the cable and 32 per cent. for the cars and passengers. Two miles of new double-track in San Francisco, fully equipped, have just cost $400,000.

I do not know that these figures call for comment, as those presented later on in regard to electricity will serve for purposes of comparison. But they may be supplemented by one or two observations. It is evident that there is an objectionable rigidity in the cable system and that it has narrow limits of applicability. A cable road, of whatever kind, needs a very large patronage. Mr. P. A. B. Widener, well known in connection with Philadelphia street railways, said last year: "To maintain a cable road you must have a certain amount of business in order to be self supporting. It costs as much to run the cable for half a dozen cars as for half a hundred. Small roads, or feeders to the main line, are run more cheaply by horses." It will be remembered that great trouble was experienced in Philadelphia in rendering the cable system there operative last year. The assertion is made by those who should know that 12 miles, costing between $40,000 and $50,000 a mile, required $250,000 in repairs and renovation inside the twelve months, but as the *Ledger* put it philosophically at the time of the breakdowns:

"It is claimed that the delays and other annoyances that have been experienced by the company have been slight in comparison with those met with in Chicago when the cable road there was in its infancy." We New Yorkers and Brooklynites are more familiar with the mishaps on the East River Bridge, and from the arguments made here and elsewhere against cable roads we have learned that the cables wear out quickly, besides being ceaselessly noisy and requiring a conduit that must have such depth as to become an unhealthy drain or sewer.

We reach now, in the due course of our survey, the use of electricity as compared with horses or cables. You will, I believe, bear me out when I say that the confidence of electricians in the ability of electrical means to propel street cars is as strong as it could possibly be, and is, moreover, based on no small amount of work and experience. I might affirm that the general introduction of electric motors is now largely a question of coal bills. I might affirm that it has more and more resolved itself into a question of mechanics; and in both statements I should have your concurrence. I might broadly state that in Europe, where a large number of electric roads exist already, they are paying well and multiplying; and that such roads in this country had, some months ago, carried altogether over a million passengers, or a daily traffic of 3,000 passengers for a full running year, without any recorded injury to a single patron, while several new roads have of late gone into successful operation. But at the risk of covering much ground with which you are familiar I shall venture to give an outline of some of the methods by which electricity is applied to street-car service, as well as some of the data establishing its claim to superiority. I do not know of any point on which a fair comparison need be shirked; I do not know of any difficulty that can tame the infinite variety of our electric art, and as this society has never hitherto had the subject before it, I am encouraged to go a little into detail.

We have, in using electricity for street cars, the option of so many methods that the very flexibility of the application becomes a recommendation. We shall, perhaps, best spend our time in considering three or four of the leading methods, with incidental reference to the peculiarities of individual cases in each. I propose to take the third rail system, the overhead system, the conduit system and the storage system, and, without any intention of invidious discrimination, to pick out, for the exemplification of each, some of the roads and cars that have been running or can be seen and tested.

Let us begin with the third rail system. The Daft road at Baltimore, now in its second year, has been so often described that full details are not here necessary, but it furnishes some interesting figures. The cost of electric power there against horse power at $6.50 per car has been $4 per car per day, with an increase for the year of 83,986 passengers. Mr. T. C. Robbins reported as follows to the street car convention: "It was started on a purely commercial basis, as a purely commercial transaction, and has continued, and is now being extended, simply because it has proved its right to stay by the performance, which leaves little to be desired." The largest item in the expenses at Baltimore is coal at $3.50 a ton. Another third rail road, the Highland at Detroit, on which there are none of the grades and curves that rendered the Baltimore road expensive as to fuel, is in very successful operation. Like the Baltimore road, it has a wheel for making contact, but, unlike it, has the third rail neatly sunken between planks. It runs out of the city for three miles. The car in use is the same as those on Broadway, this city. Mr. Frank Fisher, whose motor is used, informs me that on a recent Sunday, on a thirteen hour schedule, the road carried 5,500 passengers. The coal consumption was a little over 400 lbs. The coal—screenings—costs $1.25 a ton. The success has been so great as to lead to a development of plans matured for the increase of the service there and on a new local road to be begun in the spring.

You will agree with me, I think, that third rail systems must be limited to a low electromotive force, and to suburban or rural districts. Even there they have a large opportunity.

Coming to the overhead conductor systems, the Van Depoele roads form an important group. These roads are now in operation at Detroit, Port Huron, Mich., Windsor, Can., Appleton, Wis., Montgomery, Ala., and Scranton, Pa. Mr. Van Depoele suspends his feeding conductor by side poles, or, as at Appleton, has double wires, corresponding to the track, but immediately above it at a height of 18 or 20 feet. The little Windsor road, two miles long, with two cars, started in June, 1885, has paid for itself. I may mention that when I went on it last August, one evening, I visited the generating station. It was deserted and in black darkness. I made the trip and then went back to the station. The darkness was blacker, and there still was no sign of attendance, but the 30 or 40 passengers each turn were none the wiser and none the worse. I don't approve such practice, however. The Appleton road, with five cars, is the first in this country run by water power, depending, and with great success, upon a pair of turbines that will develop 100 horse-power and are now driving a 60 horse-power dynamo. The Montgomery road is notable as being a complete city system, including ten miles of track. The Scranton road that started last week has two features of special interest. One is that in a city of about 50,000 or 60,000 inhabitants the use of the overhead conductor is allowed. Another is that the line is operated from the electric light station. The road is 2½ miles long, with 12 grades, mostly over 6 per cent. There are already in use two heavy Pullman cars, running at a speed of from 4 to 15 miles an hour. The current is conveyed by a conductor $\frac{3}{10}$ of an inch in diameter, the rails forming the return. A traveler with rollers and a flexible cable passes the current to the motor, which, it is worthy of notice, stands upon the front platform in sight of the driver. The electric light station is well satisfied with only $9 a day for running the 60 h. p. generator, and it is evident, therefore, that an increase of rolling stock will involve very little increase in cost of power. Here is a hint by which electric light men nearly everywhere might profit.

In the overhead conductor category should be included Mr. Daft's new roads at Los Angeles, Cal., one 3½ miles long and the other 2½ miles. A peculiarity is the placing of the motor in the centre of the car, occupying the room of but two passengers, and leaving both platforms clear.

The overhead bare conductor systems are also restricted to currents of low electromotive force. But they, as well as the third rail systems, do work it is impossible to perform remuneratively by cable, and which would often be beyond the range of horse or mule power on either philanthropic or business principles. Provided permission is obtainable for running the wires, the overhead conductor system seems cheapest, if not best, for cities up to at least 50,000 population. I believe a double overhead conductor system well built should cost from $1,500 to $2,000 per mile. The single conductor is, of course, much cheaper.

There are in the United States about 40 cities with population above 50,000. In almost every one of these it would be necessary to resort to the electric conduit system, third on our list, unless the storage system be tried, or a combination of the two. At the present time, the outlook for electric railways with conduited mains is very favorable.

The first exemplification of a conduit system in this country was given by the Bentley-Knight Electric Railway Company in 1885 at Cleveland. A working section of their line can now be seen at the Rhode Island Locomotive Works, and as it illustrates in a striking manner the principles involved, I will touch on a few of the leading points, now described for the first time. The conduit is made to resist the heaviest wear and strain of street traffic. The surface opening or slot is only ⅛ of an inch wide, and the total width of metal at the street surface is but 3 inches. The conduit is kept clean by a broom of peculiar shape suspended from the car. This broom is said to have swept out in a single trip the accumulation from 12 hours constant snowing. At convenient points catchpans with sewer connections receive the sweepings and effect drainage. The two main conductors consist of channel iron connected by expansion joints and lined with a continuous strip of copper of sufficient size to carry the current with but small loss of energy. These conductors are fastened to the side walls of the conduit on insulators of vulcanized wood dipped in white lead. The insulators are strongly set in sockets in the cast-iron supporting yokes. Neither the traffic rails nor the conduit structure form any part of the electrical circuit. To provide for switching a movable tongue is pivoted at the point of branching, so as to rest on the top of the conduit and to be readily set to close either of the branch slots and direct the contact plow into the other. A corresponding conductor tongue within the conduit is moved at the same time. The contact plow for making connection consists of a flat frame hung from the car by transverse guides, on which it is free to slide the whole width of the car and extending thence down through the slot of the conduit. It is provided with a swivel joint, so as to adjust itself to all inequalities of road or conduit. This frame carries two flat steel insulated conductor cores, to the lower ends of which are attached by a spring hinge small contact shoes of chilled cast iron that slide along in contact with the two main conductors. At the upper ends are flexible connections leading to the motor. This plow can be inserted or withdrawn through the slot at will, the spring hinge allowing the contact shoes to straighten out into line with the conductor cores when the plow is pulled upward and the shoes strike the insulating lining with which the slot irons are provided. By no accident, therefore, can anything be left behind in the conduit to obstruct succeeding cars. The plow guides are hung on transverse axes, and are held in a vertical position by a spring-catch that gives way when the plow meets an irresistible obstruction, and hence the plow is automatically thrown completely out of the conduit without injury, being also immediately replaceable. The contact shoes will stand weeks of wear and cost next to nothing. The frame of the plow has wearing guards of hardened steel wherever it can touch the edge of the conduit slot, and these are also readily renewed. Two plows are used on each contact for the sake of absolute reliability, and to prevent flashing at the contact. The connection between the wheels and motor consists of a system of gear wheels and connecting rods, the gears being deadened so as to be quite noiseless. The company makes a completely equipped steel-framed truck, with motor, etc., upon which can be placed any car body. These have a wheel base of 6 feet, a standard gauge of 4 feet 8½ inches, and can be used on curves with

* Read before the American Institute of Electrical Engineers, Dec. 7, 1886.

a radius of 45 feet. A motor of the Gramme type is used under the car. For long distances, the motors are in series, with current constant; for short distances, the motors are put in multiple arc, and a new form of resistance is used.

Such are the main features of the system. Of its eminent practicability there should be no doubt. The question again is one of expense, and I therefore give transcripts furnished me by Mr. R. W. Blackwell, of actual estimates submitted quite recently and now under consideration. The first is for the equipment of existing street railways in the City of New York, 3 miles, 1440 ft., double track, minimum headway 1½ minutes, average speed 7 miles per hour, running 24 hours per day, very heavy traffic, maximum grade 3 in 100.

CONSTRUCTION AND EQUIPMENT.—Conduit and conductors, 34,560 ft., at $3, $103,680; motor trucks, 37 at $1,200, $44,400; 50 h. p. dynamos, 12 at $2,500, $30,000; steam power plant complete, $27,750; foundation, $5,000; engineering, $3,000—$213,830.

ANNUAL EXPENSE.—Coal, 14 tons per day, at $3, $15,330; engineer and assistant, at $2.50 and $2 per day, $1,642.50; firemen, 3 at $1.50 per day, $1,642.50; machinists, 2 at $2 per day, $1,460; total running expenses, $20,075. To which should be added interest on construction cost ($213,830) at 6 per cent., $12,829.80; and also depreciation of plant at 3 per cent., $6,414.90; total expense and charges, $39,319.70.

The second is for a down town cross-town road in the city of New York, greatest grade 1 in 12, double track: 12,660 ft. conduit (extra heavy), at $4, $50,640; 20 motor trucks complete, at $1,200, $24,000; six 50 h. p. dynamos, at $2,500, $15,000; steam plant complete, $20,000; foundation, $2,000; engineering, $2,500—$114,140.

Of course, I do not present these figures as those upon which all authorities are agreed, but they have their value as being bids on actual work.

The conduit system of Mr. W. M. Schlesinger, in use for four months past by the Union Electric Company at Philadelphia, with a car running 9½ miles an hour, has noticeable peculiarities. It consists practically of two conduits, the upper of heavy channel iron for connection, the lower of wood or cement for drainage. To insulate the conductors, an angle iron is riveted to the top flange of the channel iron in such a manner that one of its flanges pointing downward parallel to the main side of the channel iron forms one side of the slot. In the inverted trough thus formed, the copper bar conductors are fastened, the contact being on the under side. Against the conductors, pulling upward, rub or press springs, making a firm, close

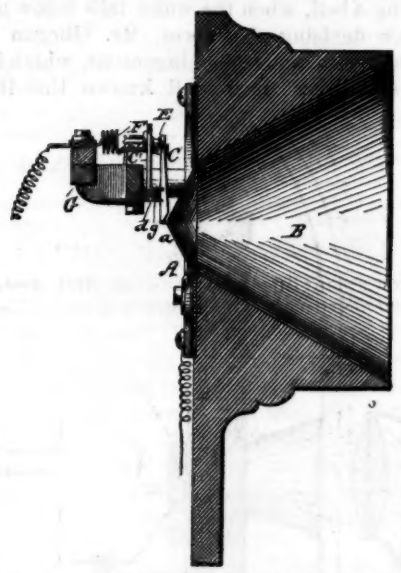


FIG. 1.—THE DANN AND LAPP TRANSMITTER.

contact under control by means of a frame holding the springs. In Mr. Schlesinger's system, the motor is under the car between the axles, and geared to them by means of chains. The motors are intended to work in multiple arc.

There are other conduit systems, among which I might mention the Van Depoele used at Toronto, I believe, in 1884, at the exposition. But my object is not so much to describe all the systems as to bring up main features and relative costs. I will, therefore, pass on to point out that whereas in the cable system, with its costly conduits, the available power for the cars and passengers reaches only about 25 per cent., in the electric conduit system, requiring for generators, conduit and conductors, etc., but half the outlay necessary on a cable system, the net return of power, as you are well aware, reaches at the minimum from 50 to 60 per cent. Mr. G. W. Mansfield, who has had considerable experience with the Daft Company, puts it as being at least 56 per cent. I note, too, that with the use of the Holroyd Smith conduit system, the Blackpool road, England, has reported earnings of $1,735 in a week, with a total expense account of $225, running 2,760 miles and carrying 44,306 passengers.

A distinguishing feature of the conduit system is that it is the only one with which high potentials can be employed on the streets. With it, also, the power stations can be placed near ample water supply or where rents are low, or can each be given a section of road to operate.

I approach the next and last system on our list, that of storage, with some degree of nervousness. In more than one quarter the man who comes out with a kind word for the secondary battery is set down as either a knave or a fool. I cannot see why he should be regarded as either, although he may perhaps be more than ordinarily sanguine and hopeful. I have myself ridden very comfortably in a street car propelled by storage batteries, so that I know the thing can be done, and I understand that storage is to be extensively used at an early date by the North Metropolitan Tramway Company in London. At Antwerp, in 1885, after six months' competition with four other cars using either steam or compressed air, the Julien electric storage car took the first prize, awarded by a jury of well-known experts. There were in all twenty-three points of comparison. The Julien car has since been tried in Hamburg, and another has been in operation on the Eighth Avenue line in this city. Mr. Widener, of the Philadelphia cable line, has traveled on it and is to try it, being very favorably impressed. But as he remarked publicly: "The question is as to the cost of maintenance of the cars and the furnishing of motive power." It will be admitted that there are advantages in having each car an independent unit, offsetting the disadvantage of carrying the dead weight of batteries; and that single cars on any road can be taken in hand for change, so that existing rolling stock can be progressively adapted to the new conditions. This involves a smaller initial outlay and gives opportunity to

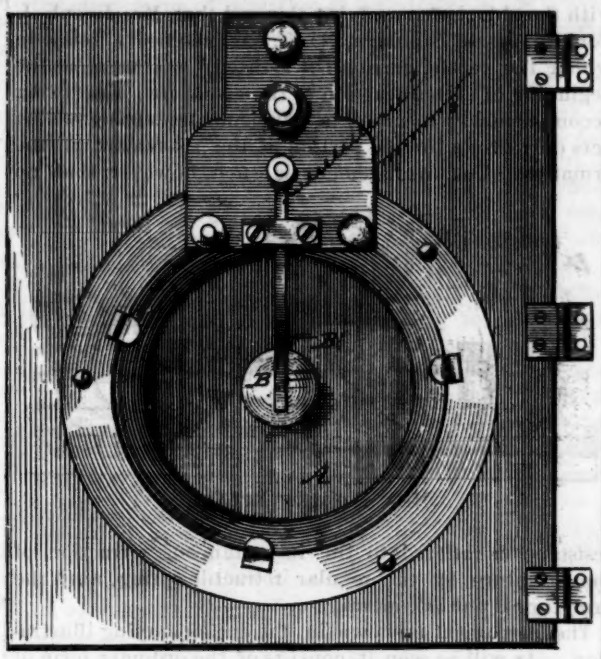


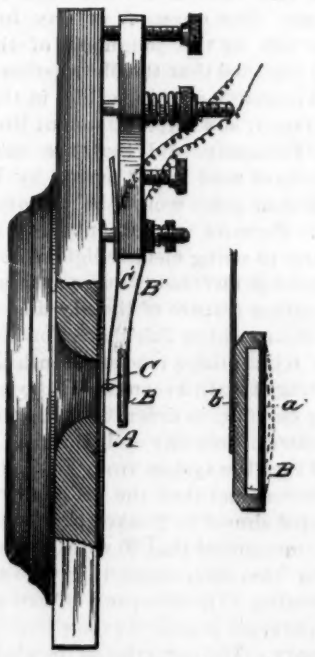
FIG. 2.—MODIFIED DANN AND LAPP TRANSMITTER.

train the present force in its unfamiliar though simple duties. Now, regarding first cost—I have never seen any figures as to the expense of an equipment of a car with storage batteries. It has been said that two sets for an ordinary street car would cost about $1,500. That seems high. The Julien Company states that the cost of the horses for a car more than covers the initial outlay of the change, and I believe the firm estimate is also made by the company of a total daily running expense of not to exceed $5 per car in cities on heavy traffic. As to life of the batteries, those in the Hamburg Julien car have now been in daily use since April, and they show by test a return of more than 80 per cent. of the power with which they are charged. The car is running on regular daily service. In respect to American storage batteries, it may be mentioned that the Electrical Accumulator Company, whose officers have a standing in electrical circles, guarantees two years' life for its new battery and an 80 per cent. return of power. The criticism has been made that ordinarily 20 per cent. of the stored energy is retained on each emission, but obviously that is no loss, forming simply 20 per cent. of the succeeding charge.

Putting it broadly, the storage system, in spite of its various conversions of energy, has a superiority of at least 25 per cent. over cables. Some of you will put it far higher, but as I have said, in the absence of the data of prolonged work, I prefer to put it low.

I think we shall see a number of efforts shortly made in the direction of using secondary batteries for regular work on street cars, and the results will merit our most careful study. There are, moreover, some ingenious propositions for combining the conduit and storage systems, so as to enjoy the benefits of both. Mr. J. M. Pendleton has described a plan of his of this nature, and Mr. Elias Ries, of Baltimore, has also carefully elaborated such a system, in which storage plays an important part.

Here, then, illustrated in a variety of ways and by numerous examples, we have a comparison of electricity with other power for propelling street cars, and an idea is given, very imperfectly, of the wide range of choice that electricity itself offers as to methods and means. Much



FIGS. 3 AND 4.—DANN AND LAPP TRANSMITTER.

of what has been said has its direct and favorable bearing on elevated railway traction, as well as on that for underground railways, but the time will not permit me to pursue the subject any further. Many points of discussion arise as to the connection of the car axles with the motor; the use of independent motor cars or of motors on the passenger cars; the types of motors and of conduits or conductors; the potential that is safe under certain conditions; the methods of regulating motor speed; the use of resistances; but all these and others I may leave to you, many of whom are doing practical and creditable work in this field, and who by thus "hitching your wagon to a star," have shown that street cars, if run by electricity, may yet be brought up to the most advanced notions of humanity, comfort, convenience and economy.

All that remains is to press onward and occupy the pre-empted territory that awaits us. As Emerson says: "Our duty is plainly not to throw ourselves across the track, not to block improvement, not to sit still till we are stone; but to watch the uprise of successive mornings and to conspire with the new works of new days." This sentiment may surely be appropriated by modern electricians, who every year put their skill to some severer test and every year win fresh triumphs. In beginning this street railway work, we may count on a large and profitable travel for some time to come, through the mere novelty of the thing, but as the art improves it will more and more manifest its right to street railway propulsion on the strictest business principles, as well as on every other ground of merit.

The Dann and Lapp Telephone System.

The telephone war which has broken out in Rochester and which threatens to spread in the northern part of New York State has called into existence an association which, it is said, proposes to discard the instruments of the Bell Company and to employ those of Messrs. John E. Dann and John Lapp, of Honeoye Falls, N. Y. These instruments are claimed to differ essentially from those in present use, being of the "make and break" type, and hence a description of them will be far from uninteresting at this time.

Two forms of transmitter have been devised by Messrs. Dann and Lapp. In one, carbon is employed as an auxiliary and in the other the action is entirely a molecular one, without the use of carbon. The first form of instrument is shown in section in Fig. 1. In this the sheet metal diaphragm *A* has a central conical portion *a*, which forms an extension to it. By this construction the whole force of the sound waves are concentrated upon the centre of the diaphragm. A lever *C*, which constitutes one of the electrodes, is permanently attached to the apex of the cone *a* by a spring which allows the lever to vibrate between certain narrow limits. The fulcrum of the lever is a spring or flexible plate *d*, which is held by a clamp. A shorter lever *C'*, is arranged parallel to and in front of the former *C*, and also attached to its middle portion by a

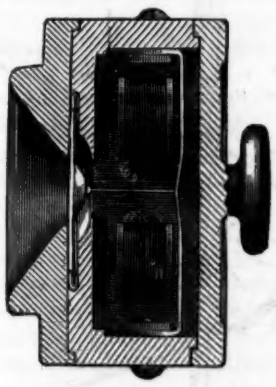


FIG. 5.—DANN AND LAPP RECEIVER.

short spring *g*, which constitutes a yielding fulcrum that permits slight movement of the shorter lever toward and from the other. The outer or free end of this lever *C'* has an eye or socket that holds the other electrode, which consists of a short metallic pin *E*, which is insulated. The inner end of the pin *E* rests normally in light contact with the free end of lever *C*, and it is the vibration of these two parts *C* and *E*, corresponding to the vibration of the diaphragm, that effects the transmission of speech. The pin electrode *C* is connected by means of a spiral spring *F*, with a lever *G*, by which it is supported and adjusted.

The carbon at *E* is only employed as an aid to avoid the "stick" which two metallic electrodes exhibit, so that the instrument is of the "make and break" type.

In seeking to overcome by other means the "stick" of metallic electrodes, Messrs. Dann and Lapp found that an improved result could be obtained by the use of a local circuit acting through the electrodes reversely to the main circuit; but greater effect could be obtained by using electrodes of different metals which are non-attractive or mutually repellant.

In the second form of transmitter, however, they embody the well-known principle that certain metals, notably iron, expand when under the influence of the electric current, and this property is employed to aid mechanically in securing the desired freedom of vibration of the electrodes.

The illustrations, Figs. 2 and 3, show the instrument in rear view and in section. As will be seen, the diaphragm *A* is of the usual construction, and the two electrodes *B* and *C* are suspended from springs, and connected to the circuit in the ordinary way.

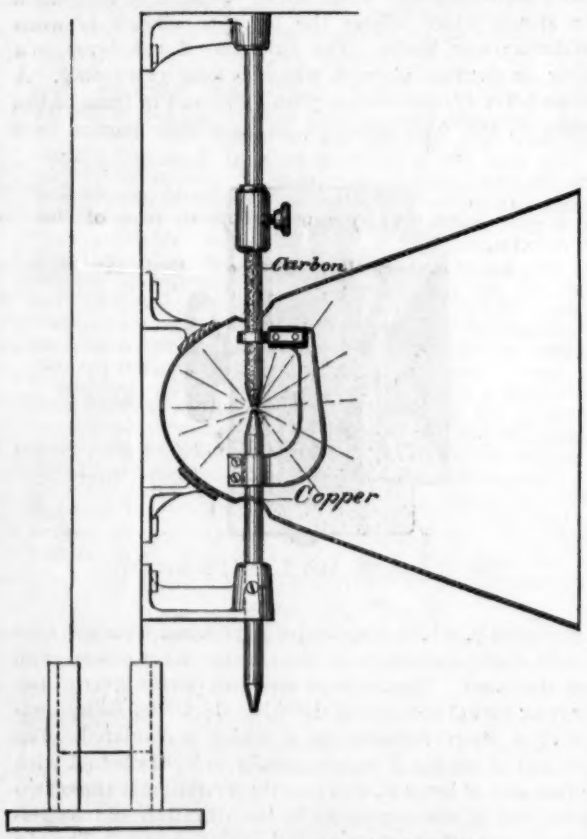
The construction of the larger electrode *B*, in which the working principle of the instrument is embodied, is shown in detail in Fig. 4. It consists of a thin metal disc *a*, made of iron, and a holder *b*, of brass, which is not subject to appreciable expansion under electrical influence. The holder *b* has a circular recess, and is provided with an

internal shoulder or rabbet, into which the diaphragm *a* fits snugly. This close fit is necessary, since the desired action of the larger electrode depends mainly on the expansion of the central portion of the diaphragm. Now, when a current passes through the diaphragm of the electrode *B* it expands; but, being confined at its outer edge, the disc *a* is bulged at the centre, as shown in outline in Fig. 4, and it is this change of form which assists in the rapid make and break required.

The receiver which it is proposed to use in connection with the transmitter is shown in Fig. 5. In this two horse shoe magnets are employed, their armatures being connected by a flexible steel spring. At the centre of the spring, a rod is attached to the centre of the diaphragm, by which the vibrations of the armatures, under the influence of the current, are transmitted to it. The coaction of the magnets is said to greatly increase the volume of sound emitted by the receiver.

New Electric Locomotive Headlight.

The trying conditions in which an arc lamp is placed when employed as a locomotive headlight make it important to guard against the disturbing effect of vibration and, at the same time, to maintain the arc in the focus of the reflector. These conditions have given rise to quite a number of devices, the most recent of which is the electric headlight of Mr. George C. Pyle, the electrician of the American Electric Headlight Company, of Indianapolis. Our illustration shows the general features of the lamp, which are of considerable interest. Mr. Pyle maintains the arc at the same point, or the focus, by making the lower electrode a stationary copper rod while the upper positive electrode consists of the usual carbon and is regulated by suitable mechanism. In order to steady the carbon, a brace is clamped to the copper rod, from which extends an arm that embraces the carbon electrode so that it is guided and cannot be shaken out of line by the jarring of the engine. The guide is, of course, insulated for obvious reasons. The arm is very thin in the direction in



New Headlight for Locomotives.

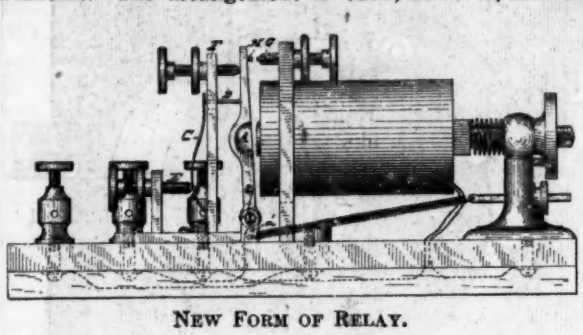
which the rays of light are projected, so that it does not obstruct them.

In the practical operation of the lamp the quality of the current is modified somewhat from that usual in lamps having both electrodes of carbon, so as to increase the quantity while reducing the electromotive force thereof, and a somewhat shorter arc than usual is used. Under these conditions, according to Mr. Pyle, when the lamp is in action, carbon is vaporized from the positive pole and projected and deposited on the copper tip of the negative pole, as indicated in the figure, thus forming a film of solid carbon thereon, which is maintained by fresh deposits continually. By this means, it is claimed, the copper pole does not burn away appreciably, and does not appreciably tint the light of the arc, and it becomes the equivalent of a carbon pole without its disadvantages. Hence by these means not only is the arc kept at a constant focus by reason of the stationary and non-consuming negative pole, but by means of the steadying and guiding arm, embracing the electrode near the arc, all lateral play or vibration is prevented, and the arc is maintained laterally in a fixed position.

The Buffalo Electrical Society.—At the meeting of the Society on Dec. 3, Mr. G. W. Felton, manager of the Western Union Company at Chicago, delivered a very interesting address on "Ocean Currents" and the relation of the sea to electricity.

A Novel Telegraph Relay.

During wet weather, the attractive force of the magnets of the ordinary telegraph relay is frequently not sufficient to overcome the tension of the retractile spring, owing to the escape of the current. Consequently, the relay fails to work in unison with the transmitting-key of the operator at a distant station, while it responds freely to the key at the station where the main-line battery is located. It is with the object of remedying this evil that Mr. Joseph I. Conklin, Jr., of Brooklyn, N. Y., has designed a relay in which the feeble current is "assisted," as it were, at the beginning of each attraction of the armature; this being accomplished by means of a supplemental spring which acts only over a limited portion of the movement of the armature. The arrangement is such, however, that no



New Form of Relay.

resistance is offered to the instantaneous retraction of the armature by the regular retractile spring, until the armature is out of contact.

The instrument is shown in the accompanying illustration. As will be seen, it consists of the ordinary form of relay with the addition of the supplemental spring *C* which bears against the pin *D*, attached to the armature *A*. Now, when no current is on, or during breaks, the armature rests against the upper back stop-screw, as shown. The spring *C* is now in tension, and tends to force the armature, through the medium of the push-pin *D*, toward the magnets. Consequently, when the latter are electrically excited, the spring serves to assist in overcoming the inertia of the armature and the tension of the retractile spring *a*, and a very feeble current suffices to make the instrument respond properly. After assisting to start the armature, the working end of the supplemental spring *C* comes in contact with the face of the standard in front of it, so that its action ceases just before the armature reaches its front contact; the armature being by this time so near the magnets that the attractive force, although weak, suffices to complete the movement of the armature. The retractile spring *a* now acts with full force on the armature preparatory to and succeeding the next break in the current, and its retractile force suffices to draw back the armature and put in tension the supplemental spring preparatory to the next make of the current. And thus the operation proceeds, the supplemental spring being adjusted, if need be, by the screw *E* to increase or diminish its effect in assisting the magnets or counteracting the retractile spring.

By this means, it is claimed, the sensitiveness of the relay is greatly increased and its operation in trying weather greatly facilitated.

Snow and the Subways.

At the regular meeting of the New York Subway Commission last week, Mr. Kearney, its engineer, reported that the weather had interfered with work on the new sections of conduit. The question of any further work this winter was left to the judgment of the engineer. Engineer Brown reported that the Metropolitan Telephone Company would probably put its cables in the sixth avenue conduit on Jan. 1, and Superintendent Brown, of the Western Union Company, said that the cables for the Third avenue elevated road would arrive by Dec. 15, and that the Third avenue poles would be removed when the cables were laid. Permits were granted to the Harlem Lighting Company to string electric light wires in Harlem for the convenience of merchants during the holidays.

The most important feature of the meeting was the application of the Metropolitan Telephone Company to renew 483 poles on the Kingsbridge road and Tenth and Eleventh avenues, connecting at Sixth avenue and Fifty-eighth street with the subway conduit, in order to complete a through telephone line between this city and Boston. The representation stated that the system from New York to Philadelphia was a success and that the present system, which was now completed almost to Yonkers, was experimentally satisfactory. He mentioned that 30 wires would be brought into the city by this line, connecting with the principal cities along its routes. The company offered to remove 58 old poles along the route in order to show that it only asked what was necessary. The commission decided to make a personal examination.

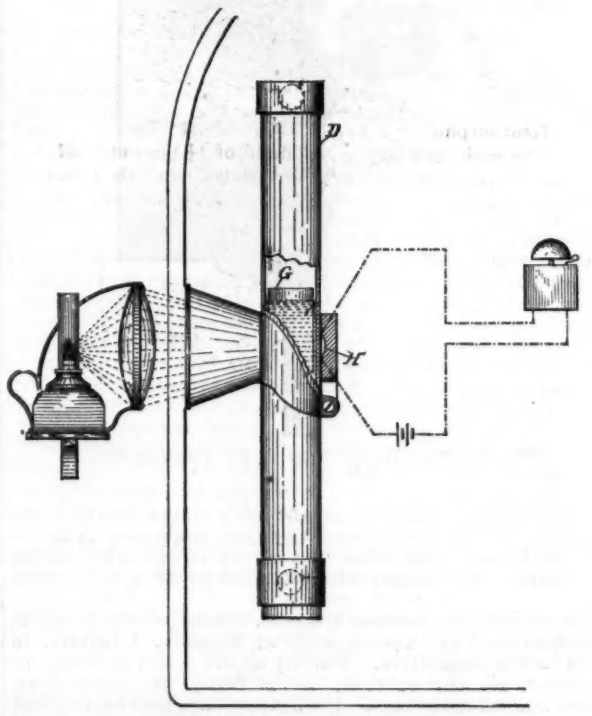
The knowledge that the New York Underground Telegraph Company, of which William H. Johnstone is General Manager, was contemplating another attempt to lay conduits this month has led to the serving of papers requiring the Johnstone Company to show cause before the Court of Common Pleas, why an injunction pendente lite, and also a permanent injunction, should not be issued restraining it from laying any conduits in the streets of this city.

The application is made on the affidavit of Subway Commissioner Daniel L. Gibbens, who rehearses the relations existing between the commission and the Johnstone Company and its threat to continue its work. The affidavit of all the Subway Commissioners goes into greater detail. It declares that the New York Underground Telegraph Company has no such rights as it claims, and if it ever possessed them that they have been lost and are now lapsed by reason of delay. It is set forth that such construction would result in great and irreparable injury to the Board of Subway Commissioners, that it would disarrange the general plans formed by the commission in pursuance of the law, and make it impossible for it to carry out its obligation. They therefore pray that the New York Underground Telegraph Company, inasmuch as its proposes to use streets already included in the plan of the commission, be restrained from placing conductors or conduits in any of the streets of the city without first filing with the board maps showing the streets it desires to use and the character of the method it proposes to employ, and without first obtaining a permit from the board. Charles A. Hess, of No. 206 Broadway, is the attorney for the plaintiffs, and the Johnstone Company will be represented by John R. Dos Passos.

The Johnstone Company claims that no subsequent legislation can deprive the company of its rights, inasmuch as it has fulfilled the conditions imposed by the act of incorporation and the general telegraph act of 1848.

An Electric Low-Water Alarm for Steam Boilers.

In our issue of Sept. 18 we illustrated and described an ingenious method of sounding an alarm when the water in a boiler sinks below a certain point. This method, devised by Mr. John J. Ghegan, consists in placing in a float within the gauge-glass of a boiler a piece of iron which acts upon a magnetic needle located close to the tube. The deflection of the needle closes an electric circuit including a bell, when the water falls below a certain level. Since devising that form, Mr. Ghegan has hit upon another idea, equally as ingenious, which involves the use of selenium. It is well known that this body



Automatic Liquid Level Indicator.

possesses the property of changing its electrical resistance under the influence of light, so that when removed from darkness to light its resistance decreases in very great ratio. The manner in which this idea is carried out in practice is shown in the accompanying illustration. Attached to the glass level tube on one side will be seen a lamp, the rays of which are concentrated by a lens upon a strip of selenium *H*, on the other side of the tube. On the level of the water there floats a piece of cork or wood, so that when the water is at its normal height the rays from the lamp are intercepted and do not strike the selenium. The latter is in circuit with a battery and bell, and under these conditions its resistance is so high that the current is too weak to ring the bell. Now when the water sinks in the tube the float is carried with it and the rays of light fall upon the selenium. The result is that the resistance of the latter decreases and the current becomes strong enough to ring the bell, which warns the attendant.

Magnetic Disturbance.—A dispatch of Dec. 8 from Rochester, N. Y., says: A magnetic disturbance of great intensity was noted here to-day. At 11:20 A. M. a magnetic needle two feet long moved over an arc of five degrees. The motion of the north pole of the needle was from a point two degrees to the west of the magnetic meridian to three degrees to the east. This is the most violent magnetic disturbance since that on the morning of Sept. 1 following the great Charleston earthquake.

Prices of Carbons.

The following important circular has been issued recently by the carbon manufacturers:

"With a view of improving the quality of the products shipped and preventing the shipment of lower grade and inferior goods, with the consequent variation of prices and uncertainties of results, the undersigned carbon manufacturers in convention have considered these questions. The result of their deliberations was, that a uniform scale of moderate prices would be of benefit both to the consumer and manufacturer, and they have agreed upon the following schedule:

7/16 × 12	$12.00 per 1000.
9/32 × 12	13.50 "
1/2 × 12	15.00 "
9/16 × 12	18.00 "
5/8 × 12	25.00 "

Odd lengths at the rate of $12 per 1,000 feet, plus 25 per cent. of the cost of the odd length. Short lengths at the same rate per inch, plus 25 per cent. Sizes other than 7-16ths in the same proportion. The above prices are all f. o. b. at factory, and for plain or copper coated carbons. Bills payable from 1st to 10th of each month succeeding sale, without discount."

The above is signed by the Parker Russell Mining & Manufacturing Co., by G. W. Parker, President; the National Carbon Co., by W. H. Lawrence, Manager; the American Carbon Co., by Chas. Heisler, Manager; the Crystal Carbon Co., by D. A. Dangler, President; the Boulton Carbon Co., by W. H. Boulton, Manager; the Pittsburgh Carbon Co., Limited, by D. D. Dickey, Manager; the Cleveland Carbon Co., by H. A. Tremaine, President. It will be noted that two large concerns are not represented in the list.

Western Union Figures.

The Western Union Telegraph Company's quarterly statement for the three months ending Dec. 31, 1886, issued last week, compares as follows with that of the corresponding quarter of last year, the figures for the current quarter being partly estimated, while those of 1885 indicate actual results:

	1885.	1886.	Changes.
Net revenue	$1,014,559	$1,000,000	Dec. $14,559
Deduct:			
Interest paid	$123,768	$123,470	Dec. $229
Sinking fund	20,000	20,000	.....
Total deductions	$143,768	$143,470	Dec. $298
Balance for dividend purposes	$870,791	$856,530	Dec. $14,261
Total surplus	$4,337,191	$6,180,792	.....

The company paid a dividend of 1¼ per cent. ($1,000,000) for the quarter last year, or $129,209 more than was earned during that quarter. For the current quarter the report says: "The committee recommend to the board of directors that no dividend be declared." No dividend was declared. The statement shows that the net revenue for the quarter ending Sept. 30, 1886, was $1,157,898, or $42,102 less than the estimate previously made for that quarter. The surplus, which on July 1, 1886, was $4,309,834, is now $6,180,792, being an increase for the six months of $1,870,958.

Mr. H. B. Hyde resigned as a director of the Western Union at the meeting, and the vacancy was not filled. The actual figures for the September quarter show that the estimated net earnings were $42,102 greater than the actual. The earnings on the stock for the Dec. 31 quarter were 1.07 per cent., and for the Sept. 30 quarter 1.26 per cent.

Magneto-Electric Induction and the Gramme Ring.

At the meeting of the Electrical Section of the American Institute, held on Dec. 8, the discussion of Mr. Townsend Wolcott's paper of the previous meeting, "On the Theory of Magneto-Electric Induction as Applied to the Gramme Ring," was resumed.

Mr. Wolcott briefly reviewed the principal points dwelt upon in his paper, published in our issue of Dec. 4. As will be remembered, his views contemplate a new analysis of the phenomena of induction and a different interpretation of the *rôle* played by the iron core or ring of the Gramme armature.

Taking, as a point of departure, the fact of the dependence of induction upon a relative motion of a conductor and field of magnetic force, he discusses the function of the iron core in dynamo armatures. After criticising the explanations currently accepted to account for the phenomenon of dissymmetry of commutation, he proceeded to give his own elucidation of what takes place. In regard to the manner in which the induction of currents in the armature wire is produced, Mr. Wolcott rejects the theory of M. Antoine Breguet, that the iron core acts as a "screen," which prevents the lines of magnetic force from acting inductively upon the inner wire. He does not, indeed, analyze the action of the iron core as a whole, but in detail. He resolves the iron into infinitesimal particles, or molecules, and arrives at his theory by tracing the polar behavior, or displacement, of each element at successive steps of its translation from pole to pole in the magnetic field as the armature revolves. The tilting or rotating movement of the polarity of each molecule is made to account for the induction taking place. This theory, it will be seen, is substantially the same as that advocated by the late Count du Moncel, and known as the "theory of polar interversions."

The views advanced by Mr. Wolcott led to a very interesting discussion, participated in by Messrs. Mailloux, Pendleton, Vander Weyde and Wetzler. Mr. Mailloux defended warmly the so-called magnetic screen theory of Breguet. He showed by diagrams indicating the course of lines of magnetic force under various conditions that the phenomena of induction as manifested in the Gramme ring could all be logically explained under Breguet's theory without difficulty, and that the fundamental experiments adduced by the author were not rightly interpreted, and did not consequently invalidate the fact that the screening action of the iron core occurred. He dwelt upon the nature of this screening action and thought that it was probably never perfect or absolute in the Gramme ring, but at best only differential, or that, in other words, there were still lines of magnetic force not screened which neutralized in part the induction taking place on the outer face of the ring. Mr. Mailloux explained that a great deal of misunderstanding relating to the screening action of the ring was doubtless due to an imperfect or rather incomplete conception of the properties of lines of magnetic force, and referred in particular to certain peculiarities of behavior in lines of magnetic force which had come under his observation, and which he had studied carefully by means of magnetic spectra taken under varied conditions. He referred to the report of his lecture before this society, published in THE ELECTRICAL WORLD of March 10, 1883, in which some of these spectra were reproduced. He regarded phenomena like these as being such as no complete unimpeachable theory of magnetism could afford to exclude from its premises. It occurred to him that in the depths of that vast subject, there might yet remain a few unexplored and even undiscovered recesses rich with facts now unknown to us, in spite of the efforts of Faraday, Weber, Hughes and other equally able researchers. He paid a high tribute to the efforts made by Maxwell to analyze in the crucible of mathematical logic the wealth of facts given him by some of these explorers and to find in them the "trail" or pathway leading to and through the "undiscovered country." He spoke in equal terms of the labors of Clausius, Froelich, Thompson, Rowland and like mathematicians to adapt the same powerful methods of analysis to magneto-electric induction as we find it in the dynamo-electric machine. Nevertheless, while appreciating fully the invaluable services of these men to this study, and while admitting that the evolution of the problem had progressed, he thought we were still considerably removed from the time when even such apparently magical power as mathematical analysis could furnish us with a comprehensive and exhaustive theory of magnetism and of magneto-electric induction. He thought that further "prospecting" in the unknown districts would be necessary to complete the survey from which the data yet wanting may be obtained.

Revival of the Bucket Shop War.

The old troubles in this city in connection with the Stock Exchange, the "ticker" companies and the bucket shops, have revived within the last week. The New York *Star* has been agitating the matter, and has given considerable space to it. One of the facts brought out was that from one "distributing" office no fewer than 54 bucket shops were supplied with quotations. It was stated that Mr. P. J. Morrison, the manager of the office in question, was once a telegraph operator, but that his income now reaches $50,000 a year. The charge was further made by Mr. E. H. Drake that the quotations used were those of the Commercial Telegram Company, and that they were sent over a wire from the main Commercial office at 18 Broadway to the Baltimore & Ohio main office opposite, being thence in turn transmitted to Marrin & Meier's for "distribution." Emphatic denials are given to this story by President Anderson and Superintendent Healy, of the Commercial Company, and by the Baltimore & Ohio officials. Mr. Healy said:

"We know from tracing our own wires that the wires which supply a number of bucket shops come directly from the Stock Exchange building. This will be news to the great body of members of the exchange, but it is true nevertheless. A privileged few who are in the secret keep it for their own personal gain."

"Where do Marrin & Meier get their quotations?"

"They got them over five or six wires leased from the Western Union," Mr. Healy answered, readily enough. "These wires run up into the cupola of the Stock Exchange. When the roof was being moved I tried to get in there to see what they were up to; but I was refused admission. Why, Ticker Superintendent Hutchinson of the Stock Exchange has even refused us permission to trace our own wires within the building."

"When the Stock Exchange accused us of furnishing quotations to Marrin & Meier," Superintendent Healy continued, "I laid two additional circuits of two wires each to this building, and then disconnected one of our regular wires and used the various wires indiscriminately. It didn't affect the bucket shops a bit. This demonstrates conclusively that they had not tapped our wires, as Mr. Drake charged. I then sent bogus quotations over our wires; but when I sent the third one I was told by Hutchinson that if we kept on we would be fired from the exchange. In my opinion Marrin & Meier get their quotations in half a dozen ways, and Mr. Drake knew it."

"Did your bogus quotations take in the bucket shops?"

"Not once. We had men watching the blackboards in a dozen of them, but in no instance did we find them putting up our bogus figures."

President Norvin Green of the Gold and Stock Telegraph Company resented the strictures of Superintendent Healy upon his corporation.

"We have spent a great many thousand dollars fighting bucket shops," he said. "These fellows get members of the Stock Exchange to sign their application for a ticker, representing that they keep a real estate office or a saloon or what not. Then we put in a ticker, find that they are doing illegal acts, try to remove it, and presto! they snap on an injunction. Only yesterday they worked this game on us in Brooklyn."

The case to which President Green referred was that of a man who induced a reputable iron merchant to back up his application, and then started a bucket shop on Montague street, near the City Hall, Brooklyn.

"We have an awful time with these fellows," Dr. Green continued. "It keeps the experts busy tracing their wires. Why, we have traced wires clean over to Brooklyn; there they doubled up and returned to this city, finally running up through the leg of a table into a bucket shop. We make our contracts for one year, and only with people whom we believe are reputable. Our contracts contain a stipulation that we may remove our instruments whenever we 'believe' the lessee is using the instrument in an illegitimate way. Now the courts hold that we ought to give notice before removal. If we do this an injunction is obtained at once and our hands are tied."

"But about the Commercial Company?"

"Superintendent Tinker and Assistant Superintendent Small demonstrated to the satisfaction of the Stock Exchange how the bucket shops got their quotations. Since then the Commercial has been getting off a deal of talk," replied President Green dryly.

As an example of bucket shop enterprise, President Green instanced the case of a man who sued his company for removing an instrument and "ruining his business." On the trial it came out that he was supplying half a dozen bucket shops and raking in $150 per week on an expenditure of $25 for their machine. This constituted his "business" and his only business.

Secretary George W. Ely, of the Stock Exchange, gave an emphatic denial to the "mysterious wires from the cupola" story, told by Superintendent Healy of the Commercial.

"I deny emphatically," said he, "that any wires run from any part of this building, either from cupola or cellar or any intervening space anywhere, except to the central offices of the Gold and Stock and the Commercial companies, and also from the spaces allotted to the several telegraph companies who receive and transmit quotations to neighboring and foreign cities."

The Commercial Telegram Company denies that it has ever received a cent, directly or indirectly, from Marrin & Meier for quotations, and now offers a reward of $500 to any one who will trace that firm's quotations to their source.

The motion to make permanent a temporary injunction granted a few days ago, forbidding the Gold and Stock Telegraph Company removing a "ticker" from the office of a young man named Pooton, in the Garfield Building, in Brooklyn, came before Judge Bartlett, on Saturday last, for argument and final disposition. Counsel for the motion stated that his two clients, one of them an infant, were doing a little business in the way of transmitting information regarding stock transactions for the benefit of customers. A friend made application to the proper authorities of the company for a "ticker" and it was granted. The ticker was placed in the office of his clients. They were willing to pay for its use and to comply with the rules and regulations of the company, but the company threatened to remove the instrument. The motion was to prevent them from doing this. Counsel claimed that the company was a public carrier, and as such bound to supply the service to all who asked for it. This principle of law, counsel said, had been clearly established by half a dozen claims already granted.

Counsel for the company claimed that the instrument was obtained by some one else and placed in possession of the plaintiffs without the knowledge or consent of the company, and the question was whether the company was entitled to protection.

The case will be further argued. One of the counsel for the plaintiffs said that one of the plaintiffs, named Pooton, came to Brooklyn from Boston a short time ago and procured through a friend a "stock ticker" for his office. They had done some business with the Stock Exchange, and some of their orders, he believed, had fallen into the hands of some of the "bucket shop" operators, whereupon a well-known and extensive Wall street operator, who has an office in Brooklyn, complained to the Western Union Telegraph Company, which owns the Gold and Stock Telegraph Company, and demanded that the ticker be removed. Hence the threat of the Gold and Stock Telegraph Company to remove the instrument and the application for an injunction to prevent the removal.

NEW YORK NOTES.

Office of The Electrical World,
New York, Dec. 13, 1886.

The United States Electrical Company, President J. W. Carter, Secretary and Treasurer Carl Faber, was organized three years ago. It was the outgrowth of a general electrical business built up since 1870 by J. W. Carter & Sons, who, it may be remembered, patented in 1880 the well-known extension bell. The company first occupied a small office at 286 Fulton street, Brooklyn, then took more room as the business grew, and has now removed to the large building 529 Fulton street, where it has fitted up in neat style. The location is a handy one for builders and house owners, as well as for the electrical novelty trade. The stockholders are men of prominence, with the means necessary to advance the interests of the company. The stock now carried is large and remarkably complete. The company is pushing its dry battery, of which sales are excellent, and the peroxide is also meeting with good demand. The company is manufacturing a good accumulator in all sizes, or to order, in hard rubber and glass cells, for house lighting, cautery and experimental purposes. A specialty is made of electric light, telegraph and telephone supplies. The company has a factory for turning out its work, and will shortly put on the market a dynamo for arc and incandescent lighting. It is now arranging to fit up the establishment with its own incandescent system. The company is sole agent in Brooklyn for the Callender insulated wires. The establishment will have on hand motors of all sizes, from ⅙ h. p. up. The company has offices also at 41–43 Wall street, this city.

The Direct Electric Fire and Ambulance Telegraph Company will have its office in the same building as the above. The object of this company is to connect mills, warehouses, public buildings, private residences, etc., direct to the engine houses nearest the subscribers in each district. The company has a fine automatic thermostat system, and the Board of Underwriters has allowed a rebate on insurance wherever it is put in. The system is also endorsed and approved by the Brooklyn Fire Department. The company is ready to put out its call boxes on rental, and will thus derive its revenue. The system is covered by letters patent, and its evident advantage is that the alarm goes direct to the engine house.

The Edison United Manufacturing Company has on view one of the finest chandeliers or electroliers ever made. I doubt if its equal in this line of work can be found. It is an 18-light combination fixture, and the design is strikingly bold as well as beautiful. It is encircled at the base by griffins or other fire-spitting animals of the Dragon of Wantley type. These serve as a guard, so to speak, to the structure at the top, consisting of a copy of the Temple of Diana or one of the other worthies of Lempriere's Dictionary. The effect is classically ornate. The lamps are in three rows; the bottom row or ring is seven feet in diameter. The full height is about ten feet, and the whole is of rich hammered brass brought into high relief with silver and gold. Several electroliers of this design have gone with the installation for the State House at Harrisburg, Pa. The manufacturers are Bergmann & Co.

The stockholders of the Edison Electric Light Company and the Edison Company for Isolated Lighting, representing 7,700 of the 10,000 shares of stock, held a meeting last week and consolidated the two companies, which will be known as Edison Electric Light Company. The change consists in dropping the word "the," but otherwise the company is the same as the old one. The report of the company showed that in the past year more money was earned than in all the previous years added together. The new stock in place of the old was ready and all of it was taken.

It is a great pity that New York does not enjoy in its police service the same use of the telephone that Brooklyn does. An article in the New York *World* last week said: "A police official from a city in the West visited Brooklyn a week ago and went away from the City of Churches saying that if he could make the improvements that he wanted in his own force he would keep Brooklyn in his mind. The police telegraph system was what impressed him most favorably. There is no denying the fact that it is the best in the country. Twenty precincts communicate with Headquarters by means of the telephone and dial telegraph instruments. If one breaks down the other is in use and serious delay is out of the question. Precincts are always in communication with one another, and messages are delivered and taken while New York's police officials are studying out the first sentence of the old, slow-going dial. All Supt. Campbell has to do when he wants to talk to officials in Sing Sing, Crow Hill or Trenton penitentiaries is to step into his office and call them up. Any captain in Brooklyn can do the same thing, but New York captains have to either go to Headquarters or give their business away while shouting in some neighboring establishment where there is a telephone." The force of the police telegraph department, I may add to the above, consists of Superintendent, F. C. Mason; Operators, Gear, Williams, Cornell, Campbell, Keenan and Malloy; Linemen, Manee and O'Connell; Messenger, Guise.

W. T. H.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Boston, Dec. 14, 1886.

The American Bell Telephone Company has declared a dividend of $3 per share, payable Jan. 15, 1887.

The Erie Telephone Company has declared an extra dividend of ½ of one per cent. (50 cents), payable Dec. 23. The regular dividend is one half per cent. quarterly.

The linemen employed by the Cambridge, Mass., Electric Light Company struck for increased wages Dec. 8. They were paid and discharged.

The officers of the torpedo station at Newport, R. I., unanimously favor the adoption of electric lights for all the buildings.

The Ben Franklin Electric Light Company, Manchester, N. H., is enlarging the lighting capacity of its plant. A boiler of 200 h. p. has just been put in by the Manchester Locomotive Works.

Electric light plants at Milford, Mass.; Hudson, Mass., and Portsmouth, N. H., have each been supplied with a 60 h. p. Ball automatic engine. Messrs. S. L. Holt & Co., of Boston, filled the orders.

It is reported that Messrs. W. A. Chase and F. A. Lakin recently purchased the electric light plant (Schuyler system) at Westfield, Mass. It cost those enterprising gentlemen—it is said—$25,000.

Mr. C. D. Smith, formerly the general manager of the American Electric and Illuminating Company, and now Eastern agent of the National Carbon Company, of Cleveland, is visiting Boston in the interests of his company.

The sequel to the pending Brush-Merchants' consolidation—two of Boston's leading local electric light companies—is the reported incorporation of the Boston Electric Light Company at Portland, Maine. Capital stock, $1,000,000. President, F. A. Gilbert.

The North Adams, Mass., Electric Light and Power Company intends to adopt an incandescent system, and at the same time increase the number of its arc-light machines. It has just added another Armington & Sims automatic engine to the plant equipment.

The Hyde Park, Mass., Electric Light and Power Company on Dec. 8 elected officers as follows: President, John S. Bleakie; Clerk, F. A. Wyman; Treasurer, S. B. Balkan. Directors: David Perkins, E. H. Williams, W. S. Hill, H. M. Cable, and the other gentlemen named. The capital is $20,000, said to be more than one-half taken.

The Salem, Mass., Electric Light Company some time ago ordered the fire-alarm wires removed from its poles, giving as an explanation: "That in the event of the wires of the two systems becoming crossed at night persons attending the lamps would be in danger of receiving injury." The orders receiving no attention, the electric light company removed the wires objected to, and cast them into the streets.

The following named gas-light companies have recently filed petitions to the Massachusetts Legislature asking for authority to furnish electricity for illuminating and power in the territory that they have heretofore supplied respectively with gas: The Jamaica Plains Gas-Light Company, Dorchester Gas-Light Company, Cambridge Gas-Light Company, and South Boston Gas-Light Company.

A representative of the Boston Gas-Light Company (which petitioned the Legislature a short time ago for authority to produce electricity, for power as well as for light), states that the use of electric lights in some stores has not decreased the consumption of gas, as other stores have used more gas than formerly in order to make a brilliant illumination.

At a meeting of the Woonsocket (R. I.) Gas Company, Dec. 7, a committee of three was appointed to obtain information regarding the advisability of establishing an electric light plant in connection with the company's works.

Professor Elihu Thomson, of the Thomson-Houston Electric Company, gave a lecture on an electrical invention of great importance, to the Society of Arts at its meeting at the Institute of Technology on Thursday evening, Dec. 9. The subject was "The New Art of Electric Welding." Professor Charles R. Cross, who presided, introduced Professor Thomson, who then proceeded to demonstrate to his audience how to join not only pieces of any one metal, but pieces of dissimilar metals with a true weld strongly and perfectly. The uses to which the process is applicable are numerous and of importance. It may serve for uniting wires for telegraphic and other purposes, for butt-welding water pipes or tubes, for making and repairing of all sorts of tools. The apparatus which Professor Thomson used in practically illustrating his discourse consisted of two heavy clamps to hold the pieces to be joined and convey the current. This current is produced from a special form of induction coil, which creates a current of great volume, but of low electromotive force. As the speaker clearly and comprehensively proceeded with his lecture, he stopped now and then for a few seconds only to weld wires of various sizes, and then pieces of brass, copper and other metals which were so strongly joined that the severe tests each was subjected to satisfied every one present of the practicability, importance and great merit of the subject treated upon. The audience was unanimous in the opinion that Professor Thomson deserved the gratitude of every one interested in the advancement of science.

Mr. M. E. Baird, traveling agent of Messrs. Holmes, Booth & Haydens, is spending a short time in Boston in the interests of that well-known company.

Kiernan's News Agency sends out the following: "A party in intimate relations with the Garrett interest sends us this statement: 'The Baltimore & Ohio Telegraph Company, instead of burying the hatchet with the Western Union, is now actively engaged in pushing its plant both in the West and Canada, and is also now in negotiation with some very important electricians in perfecting a system which will quadruple its facilities, which the Western Union will be unable to control or supplant. There will be no raising of tolls on the first of the year, and before Feb. 1 the Baltimore & Ohio will compete with the Western Union in almost every town and territory where the Western Union now is in control. The new roads now building are seeking Baltimore & Ohio wires.'"

W. I. B.

PENNSYLVANIA NOTES.

Pittsburgh, Pa., Dec. 13, 1886.

Another important move has been made here by Mr. George Westinghouse, Jr. He now goes in to the manufacture of a new insulated wire. The Pittsburgh *Dispatch* of Dec. 12 gives the following particulars:

"Work is being pushed rapidly in the transformation of the old Eagle Cotton Mill on Sandusky street, Allegheny, into the new underground cable wire-mill. The building was leased about three weeks ago by George Westinghouse, Jr., for a preliminary plant for the manufacture of the wire recently patented by E. G. Acheson, of this city. Carpenters are tearing out and changing the entire inside of the structure, and the machinery necessary for the plant will be put in in a few weeks, but it will probably be six weeks or two months before any wire is manufactured. The 'Acheson duplex wire,' as the new invention is called, really consists of two wires. The first, or middle wire, is of copper, about one-twentieth of an inch in diameter, technically known as No. 18, American gauge. This is completely covered and insulated with gutta percha, or the patent composition used by the Standard Underground Cable Company, nearly as thick as the wire. This is then incased in a copper tube, which is really a hollow wire, and has the same sectional area as the central wire. The final covering is cotton immersed in japanned paint. By this plan both wires are insulated and form a complete metallic circuit. The current passes over the centre wire and returns over the outer or hollow wire. The first wire being completely surrounded by the return current on the outer wire absolutely prevents 'cross talk' or induction. This makes it specially adapted to telephone purposes. One very important feature claimed is the impossibility of accident by lightning and interruption by earth currents, which occasion the humming sounds which occasionally mar the instinctive pleasures of telephone conversation. All other anti-induction wires when bundled into a cable use the earth as a return circuit. In other words, the wires are grounded at the termini. This is obviated by the metallic circuit of the new Acheson wire. It makes no difference whether 2 or 1,000 wires form a circuit, there is no danger of induction or their being affected by the circumstances which render other wires useless when twisted into cables.

"Mr. Westinghouse is a large stockholder in the Standard Underground Cable Company, and it was the original intention to manufacture the wire at the plant at the corner of Sixteenth and Pike street, but it was found that facilities were too limited, and the other building was leased. It is probable that the wire will be adopted by the cable company mentioned, but in regard to this Mr. Westinghouse refuses to speak. The new plant will not turn out more than half a mile of wire per day.

"Mr. Acheson, the inventor, is a young man, 26 years of age, and a resident of this city. He is a nephew of Hon. Judge Acheson, and was associated with Thomas A. Edison for over three years. He went to Europe in the latter's interest, and introduced the electric light into Italy."

I send you a sample of the wire. As you will observe, it is a No. 18 American gauge, insulated with gutta percha to No. 13. The copper tube is electro-deposited and is six one-thousandths thick. It is claimed that it will not be any more expensive than a metallic circuit formed of any of the well-insulated wire now in the market. It is said also that Mr. Westinghouse has the control of the patents for America, Mr. Acheson retaining the Canadian and European patents.

WESTERN NOTES.

Branch Office of The Electrical World,
Chicago, Dec. 11, 1886.

The tendency on the part of the gas companies to take hold of the electric light is increasing in the West. A certificate was this week filed with the Illinois Secretary of State, recording the change of the name of The Peoples Gas Light Company at Canton to the People's Gas and Electric Light Company. The gas companies are rapidly coming to the conclusion that it is more profitable to sell the electric light than to fight it, and the result will be beneficial to both interests.

Some late electric light sales of the Van Depoele Company are as follows: 30 arc lights to the Laporte Electric Light Company, Laporte, Ind.; 40 arc lights (increase) to go to Crookston, Minn., making the Van Depoele plant there 70 arc lights in all; 16 arc lights to the Chicago Base-Ball Association. This last named plant will be used to illuminate the great toboggan slide which has been erected on the grounds of the Chicago Base-Ball Association.

A. L. Ide & Son, of Springfield, Ill., find the demand for their excellent engines undiminished. They have just shipped a 50 h. p. engine with Ide's steam pump, heater and steel tubular boiler to Moore & Prunk, Wellington, Kan., to drive 50 Thomson-Houston arc lights just put in there. They have also contracted with Newton Real Estate and Investment Company, of Newton, Kan., for a 60 h. p. engine, pump, heater and boiler to drive 50 Thomson-Houston lights. They also signed a contract on Dec. 2 with the Union Cement & Lime Company, of Louisville, Ky., for one 24″ × 30″ 300 to 400 h. p. engine. This company has been running a 100 h. p. Ide engine for over a year, with entire satisfaction, and it is worthy of notice that in increasing their horse-power they still stick to the Ide engine. I learned, too, that the Ide engine took the silver medal given by the Mechanics' Institute Fair, at San Francisco, for its superior workmanship and design. I learn further that the two additional 60 h. p. Ide engines, put in the Thomson-Houston plant, are now in operation, and that the 40 h. p. engine of the same make just put in Browning, King & Company's handsome new stone store at Kansas City is driving Excelsior lights to the satisfaction of those enterprising merchants.

The Railway Telegraph Supply Company are now occupying larger and more convenient offices at 211–213 Randolph street, Chicago. This company is doing the largest and most extensive business in its history.

Captain Stone's new central office at Cincinnati now claims to be the finest telephone office in arrangement and appointments in the country. The company have just got in a new multiple switch-board, which is working as it always does, perfectly. Captain Stone has taken the opportunity, on putting in a new board, to introduce a great many improvements both inside and outside the office, and the Cincinnati Telephone Exchange is now in apple-pie order.

The Western Electric Company are so pressed with orders that they are at present finding it necessary to run their large factory night and day. Some late electric light orders received by the company are as follows: For Junction City, Kan., a 30 light arc plant; for San Diego, Cal., a 30 light arc outfit; and for Concordia, Kan., a complete installation.

The ball given in Kansas City last week by the Telegraphers' Association was a well-attended and pleasant affair.

Six hundred tickets have already been sold for the telephone ball to be given in Kansas City on the 16th.

Exhibitions of electrical apparatus and lectures thereon will form a feature of the entertainment.

Mr. H. J. Brunner, who began business in Kansas City several years ago as a blacksmith and bell-hanger, has now moved into a large and spacious store, and carries a very full line of electrical goods and shelf hardware.

O. W. Ditsch & Co., of Kansas City, deal in electrical supplies exclusively. They command a large city and country trade.

The Kansas Electric Company has been formed at Topeka, Kan., with Mr. George J. Bayless as superintendent, formerly manager of the telephone exchange there. It will be prepared to

promptly execute all orders for annunciators, electric bells, etc., and will, besides, keep on hand a supply of material for building lines. Mr. R. B. Gemmell, Superintendent of Telegraph, Atchison, Topeka & Santa Fe Railroad, is at the head of the enterprise.

Col. S. G. Lynch, of 146 La Salle street, Chicago, furnishes me the following telephone stock quotations :

Bell of Mo.	$159@$161
Central Union	49@ 50
Chicago	375@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Iowa Union	16@ 19
Michigan	73@ 75
Rocky Mountain Bell	40@ 45
United	17@ 19
Wisconsin	104@ 106

Superintendent Dickey, of the Western Union Telegraph Company, Omaha, Neb., is in the city to-day. W. A. K.

THE TELEGRAPH.

French Telegraphs.—In the New Goblet Ministry, M. Granet will continue to have charge of posts and telegraphs.

New York Rates Higher.—The Baltimore & Ohio Company has advanced rates to all points in New York State from 20 to 25 cents, conforming to the Western Union schedule.

The Commercial Cable Company is said to have done a large business during the recent heavy storms in Great Britain, which crippled the land lines of its competitors. Its receipts in the two days of gale are reported to have increased 150 and 175 per cent.

Busy Albany.—It may not be generally known that Albany is one of the greatest telegraph centres in the United States. It stands third in the number of wires that run into its office, having over 200, while New York, which comes first, has only a little over 600, and Philadelphia comes next.—*Albany Journal.*

Refusing Receivers.—At Philadelphia, on Dec. 8, Judge Butler, in the United States Circuit Court, after hearing argument in the matter of appointing receivers for the Bankers & Merchants' Telegraph Company, refused the application. There were two applications for such appointment ; one by Edwin Middleton and the other by the Farmers' Loan and Trust Company. In the former the motion took the shape of an appeal to vacate the appointment of Clinton P. Farrell as receiver.

B. & O. Extension.—The Baltimore & Ohio Telegraph Company has completed its connection with the Canadian Pacific Railway lines, thus adding another large and important territory to its system. This connection establishes direct communication between all points on the Baltimore & Ohio system in the United States, and all points on the Canadian Pacific system from Quebec to British Columbia on the Pacific coast. It is expected that the line from Vancouver to San Francisco will be completed within 30 days.

Lower Rates.—The Baltimore & Ohio Telegraph Company issued a notice last week that attracted a good deal of attention. The rate for night messages over the Baltimore & Ohio lines has been 15 cents for 10 words and 1 cent for each word additional. The announcement reduces this rate to 20 leading cities where night forces are maintained, and hereafter the night rate will be 1 cent per word for 10 words or over, delivered by messengers, and ½ cent per word when messages are dropped into the Post-Office at their destination, not less than 10 cents, however, to be accepted for any message. The Baltimore & Ohio people say that this plan has been a long time in view.

THE TELEPHONE.

Erie Dividend.—The Erie Telephone Company has declared an extra dividend of ½ of 1 per cent. (50 cents), payable Dec. 23, to stock of Dec. 13, books to reopen Dec. 23. The regular dividend is ½ per cent. quarterly.

The Tropical American Telephone Company, which has an exclusive export contract with the American Bell Company, has now arranged to offer regular telephones for sale for export on terms much more liberal than heretofore, and is prepared to fill all orders promptly.

The Amagansett Telegraph and Telephone Company has been incorporated to do business in the town of Easthampton, Suffolk County, L. I., with J. Mason Schelling r, John B. Strong, Benjamin H. Terry, George C. Hand and Joshua B. Edwards, all residents of Amagansett, L I., as corporators. The capital stock is $2,500, divided into 100 shares of $25 each.

Baseball Scores by Telephone.—In an interesting chat with a reporter of the local *Mail;* Mr. W. D. Allison, of the Chicago exchange, said : "The day the Detroits played their last series here I shall never forget. About 3:30 we had at least two hundred calls for Spalding. By 4 o'clock four hundred eager enthusiasts had shouted "Spalding." The man at Spalding's telephone then gave orders that we must not call him again, as he couldn't answer four hundred questions even in twenty-four hours, and he was right. Failing to get reply from Spalding, our subscribers turned on us, and I directed all the girls to give the score by innings; it was our only resource."

Mexico.—A City of Mexico dispatch says : "The irregularities of Reed, the treasurer of the Mexican Telephone Company, do not affect the standing of the local company here, which controls this city, also Guadalajara and Pueblo. In all three cities subscribers are increasing, and here lines and poles have been renewed, and good service is being rendered, with very few complaints. In an interview to-day with Mr. M. L. Guirand, manager of the company here, he said it was a pity when everything was going on prosperously, as the books of the company would show increased remittances to Boston, as compared with the previous year. He also said the plant had been renewed in the last two years ; that there was enough material on hand for the next six months, and that the Company, so far as Mexico was concerned, never stood better with the public or itself than now."

Taking the Case to Boston.—Mr. Jeff Chandler, of government counsel in the Bell Telephone case, said last week that the government did not propose to appeal the case to the Supreme Court, but will institute suit against the company in Boston as soon as possible. "Not," said he, "because we believe the Cincinnati decision with regard to jurisdiction to be just, or because we have any doubt in the matter, but because we realize that it would be impossible to get action by the Supreme Court for at least two years. The overcrowded condition of the docket," he continued, "would throw the case over until next term, and it would be almost impossible to get it advanced, as the court has several times refused to advance cases at the express solicitation of the Attorney-General, and it certainly would not do so in this case. We would spend two years to stand just where we are now, so that it has been deemed advisable to take the case to Boston."

The Government Suit.—At Columbus, O., on Dec. 7, the opposing counsel in the Bell Telephone case appeared in the United States Circuit Court, and the motion of the government's counsel to dismiss the case without prejudice, presumably with the intention of bringing another suit in the Massachusetts courts, was argued at length. Senator Thurman appeared for the government, and the defense was represented by Senator J. E. McDonald, of Indiana, and Hon. J. J. Storrow, of Boston. The counsel for the defense contended that it was not proper to make the proceedings in connection with the plea of jurisdiction, which was argued a short time ago at Cincinnati, a part of the transcript on appeal or removal. An agreement on this point was reached by counsel, and Judge Sage ordered the case dismissed without prejudice and without record, as far as its status in the Ohio district is concerned.

A New Telephone.—A dispatch from Galveston, Tex., says that a new telephone was recently tested there with good results. The instrument is known as the Barriett-Nelms telephone, being the invention of S. L. Barriett and W. W. Nelms, both young men and residents of Houston. The test consisted of talking over a wire 830 miles long, it being the distance to New Orleans and return. The articulation was said to be very good. "The new invention differs from the Bell, Edison and all other telephones, inasmuch as it combines the effects of an induction coil and the helix of a handphone, causing them to act simultaneously and in concert with each other by winding the coils in the same direction and using a carbon diaphragm with three carbon contacts, thus enabling the use of a large amount of battery. Yesterday's test was made with three cells. For a short distance, no battery whatever is required, the automatic dynamo current being sufficient to articulate with great distinctness and steadiness. The inventors claim they can talk from New York to San Francisco with the same distinctness as yesterday's test."

Telephone-Cum-Telegraph.—A Boston paper has this : "A story, started two or three days since, and which at the time received little credence, but which is now believed to have a very substantial basis, is to the effect that negotiations for the control of the Bell Company by the Western Union Telegraph Company are in progress, and what is more are in a fair way to assume definite shape. The present close relations of the two corporations are very well understood, and the project quietly hinted at is, so far as a combination is concerned, perfectly feasible, though public sentiment as expressed through the Legislature or by litigation, would in all probability put in the way of consummation a most formidable obstacle. Either of these companies is a gigantic power in itself, and a combination of them would give practically a grand monopoly of two of the most valuable adjuncts to business and commerce in existence, such as the age is hardly ripe for. But it is a fact that such a union has been talked of informally, and it may be, for aught that can be learned here, that it has received a more serious consideration, but whether or not it will get any further than talk, time alone can tell. In view of all the current intimations concerning the matter, the significance of the recent efforts to depress Western Union is very apparent."

THE ELECTRIC LIGHT.

Webster City, Ia., will be given the electric light by Mr. W. C. Wilson and others.

Fort Edward, N. Y., wants the electric light. Mr. C. H. Hooper is interested.

The Brooklyn Gas Company proposes to obtain electric lighting privileges.

Birmingham, Ala., has a new Edison company with a capital stock of $75,000.

Racine, Wis.—The Badger Electric Light Company is making improvements in its plant.

Manchester, Ia., is to be lighted by electricity. Mr. E. F. Keim, of Dubuque, Ia., is interested.

Newport, R. I.—It is proposed by the authorities at the U. S. Torpedo Station to put in an electric light plant.

Brattleboro, Vt., has a Jackson machine of twenty 16 c. p. capacity. Mr. C. E. Barrett will run the little plant.

The Naugatuck, Conn., Electric Light Company was recently organized by Mr. E. H. Carrington and others.

A Toboggan Slide.—The new toboggan slide at the Polo grounds, this city, has a number of electric lights all around it.

The Woonsocket, R. I., Gas Company has a committee inquiring about the advisability of putting in an electric light plant.

Norwalk, O.—The Norwalk Light and Power Company has been formed by Mr. C. H. Gallup and others with a capital stock of $25,000.

Biddeford, Me.—The Traders' Electric Light Company has been organized with Mr. O. F. Page as President. Its capital stock is $20,000.

Scranton, Pa.—The Scranton Edison Incandescent Electric Light Company has $100,000 subscribed. Its plant is nearly ready for work.

Keene, N. H.—The Keene Gas Company is getting ready for its electric light plant, and will have a 50 h. p. engine and a 60 h. p. steel boiler.

The Boston Gas Company in going into the electric lighting business proposes also to pay attention to the distribution of power by electricity.

Renovo, Pa.—The Renovo Edison Electric Light and Power Company has incorporated with a capital stock of $20,000. Mr. J. C. Hill is treasurer.

Plattsburgh, N. Y.—The Plattsburgh Electric Company, incorporated by Mr. G. D. Dunham and others, has a capital stock of $12,000.

Kansas City.—The Edison Electric Light and Power Company, of Kansas City, incorporated by Mr. K. Coates and others, has a capital of $100,000.

The Demand for Carbons.—The Crystal Carbon Works, Cleveland, O., report that business is very good, and that their factory is being worked at its full capacity.

Woburn, Mass.—The Edison Electric Light Company, Woburn, Mass., are setting a new tubular boiler with the Jarvis patent boiler setting to burn screenings for fuel.

The Boston Electric Light Company has been incorporated at Portland, Me., with Mr. F. A. Gilbert, of New Haven, Conn., as President. Its capital is put at $1,000,000.

The Cruiser "Chicago."—The Edison Company is the lowest bidder for furnishing an incandescent electric lighting plant for the new cruiser "Chicago," and will probably be awarded the contract at $8,280.

Natick, Mass.—The Natick Electric Light and Power Company have started their new station successfully. They have ordered the second Armington & Sims engine from the Jarvis Engineering Company.

The New York Aqueduct.—Nearly 150 lives have been lost at the new Croton Aqueduct works since they were begun three years ago, and the number would have been greater but for the resort to electric light of late.

North Adams, Mass.—The North Adams Electric Light and Power Company have purchased from the Jarvis Engineering Company a 60 h. p. Armington & Sims engine. Heretofore they have used line power from a long-stroke engine. They intend to run incandesent lights.

Lakewood, N. J., is to be lighted by electricity. The lights will be put in the popular winter hotel, the Laurel House, and in several of the churches. It is understood that the contract has been secured by the United States Company.

Kingston, N. Y.—The City Council of Kingston on Dec. 10 gave a three years' contract for lighting the streets of the city with 100 American arc lights. The American Illuminating Company of Kingston is now under organization and has given an order for 200 lights.

Norwich, N. Y.—The American Illuminating Company of Norwich, N. Y., was formed last week. An exclusive franchise was granted to it by the president and trustees of the village council. The company begins operations by installing a 50-light American plant, which has been ordered.

St. Paul, Minn.—An additional 50-light plant of the American system was shipped to the St. Paul Gas Company this week. This is a rapid increase since the gas people began to use the lights. The system is giving so much satisfaction to the gas companies, it is probable that its capacity will be doubled during the coming year.

Springfield, Ill.—Investigations have been going on by the State officials at Springfield, Ill., for some six or eight months regarding electric light for the State capitol building. The American system has finally been adopted. A 50-light plant was ordered from the American Company on Saturday last, and was shipped the first of this week.

In a Big Tunnel.—The great tunnel of the Baltimore & Ohio Railroad Company through the city of Philadelphia has just been finished. The deepest part of the cut is 39 feet, through solid beds of rock. The tunnel is of massive masonry and brick, and has taken a year to build. Traffic begins this week. The whole structure is made light as day by electricity.

Belvidere, N. J.—Jesse W. Starr, of Philadelphia, has contracted with the town council to light the streets of Belvidere with 30 Schuyler arc lights and 25 gas lamps for the low price of $750 a year (!). Work has been begun on the electric plant, and the gas plant will soon be under way. An incandescent machine, is contemplated for the lighting of some of the best residences, and gas is to be furnished at $1.50 per thousand. The Belvidere Gas and Electric Light Company has been incorporated and has arranged to buy out Starr's contract, with the gas and electric plants, as soon as they are in working order.

APPLICATIONS OF POWER.

Over the Drachenberg.—An electric railway is to be constructed across the Drachenberg Mountain, Germany.

The Third Avenue Road.—One of the heaviest stockholders of the company is quoted by the papers as saying that "the directors are keeping an observant eye on all new inventions, and that probably within the next eight months horses will be displaced by electricity." We hope so.

Fighting for Underground New York.—The suit of John Jacob Astor and other property owners along Broadway against the New York Arcade Railway Company for a perpetual injunction restraining the company from proceeding with the construction of its proposed road under Broadway, was begun before Judge Van Brunt in the Supreme Court on Dec. 10. The plaintiffs base their claim on the ground that the company's corporate rights expired years ago. Ex-Senator E. Thomas opened for the Arcade Railroad Company.

New Brunswick, N. J.—The *Home News,* of New Brunswick, is running its presses with a three-horse Sprague motor deriving current from the local Edison station. The paper is very well pleased, and says : "A few days ago it drove our two largest presses, a Potter and a Campbell, up to their maximum speed, printing the *Home News* and *Fredonian* editions both at the same time. We have found the motor at all times reliable." Sprague motors are also being put in by local butchers, jewelers and others, "all of whom regard their operation with satisfaction."

Washington.—It is probable that Washington will soon be provided with something better in the way of public conveniences than the present antiquated horse-car system. The motive power is to be either electricity or cables. Two bills were introduced in the Senate on Dec. 6 to authorize the change—one by Mr Voorhees, for the Washington & Georgetown Railroad, and the

other by Mr. Salisbury, for the Capitol, North & South Washington Railroad Company. Some unimportant changes are made in the route of both lines, and the new cars are limited to a speed of ten miles an hour. There is every probability that the proposed alteration in the charter privileges which this will necessitate will be granted without serious opposition at the present session. Senator Spooner promises to push the bill when reported to final action as speedily as possible.

PERSONALS.

Mr. Robert Garrett has been elected a trustee of Johns Hopkins. The choice is a good one and should be highly beneficial to the University.

Mr. F. Fosdick, well known among electricians as the president of the Fitchburg Steam Engine Company, has been re-elected Mayor of Fitchburg, Mass. He was the temperance candidate.

Mr. C. H. Hinds, the electrical manufacturer, is one of the jurors in the retrial of Alderman McQuade, one of the "boodlers," connected with the Broadway Railway "steal." Mr. Hinds has his friends' best wishes.

Mr. Edward Weston received at his private laboratory in Newark, last week, the members of the Society of Mechanical Engineers, which has been in session here. The visitors were greatly pleased with what they saw at the laboratory.

Mr. John J. Ghegan, of Newark, N. J., who is winning reputation for originality in electrical invention, has, it is said, devised a most ingenious system for the protection of railway express cars, which almost invariably carry valuables, and have often been robbed. By Mr. Ghegan's system the car is always in connection with other parts of the train, and regular as well as chance alarms can be given. In view of recent events, the demand for something of this kind is pressing.

Death of Mr. O. A. Simons.—It is with much regret that we announce the death of the President of the Fort Wayne Jenney Electric Company. The following dispatch from Fort Wayne of Dec. 10 gives details: "Mr. Oscar A. Simons, President of the First National Bank, has been suffering for some time from nervous prostration, the result of overwork. To-day his ailment became unbearable, and telling his brother-in-law, Mr. Esmond, he could endure it no longer, Mr. Simons jerked a revolver from a bureau drawer and shot himself through the temple. The dead man was the wealthiest citizen of Fort Wayne."

MISCELLANEOUS NOTES.

The Smith Electric Company, Attleboro, Mass., will hereafter carry on the business of Swift & Smith, who have dissolved partnership. Mr. H. E. Swift retires, and Mr. E. B. Smith will conduct the affairs of the company.

BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver steel and iron wire, shafting tools, etc.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

December 18, 1886.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	40
Am. Tel. & Cable	.....	75
Cen. & So. Am.	75	100
*Com. Tel.	103	.....
*Gold & Stock	92½	97½
*Inter. Ocean Tel.	92	97
N. Y. Mutual	72	.....
Pac. & Atl.	45	55
*Postal T. & C.	30	35
South. & Atl.	65	75
W. U. Tel.	73½	73⅝
W. U. Scrip	68	.....
W. U. Bonds	.....	123
Mut. U. Bonds	85	85½
TELEPHONE.		
Am. Bell	203	204
Am. Speaking	110	130
Erie	29	30
*Hudson River	45	55

TELEPHONE.	Bid.	Asked.
Mexican	.....	.....
*N. Y. & N. J.	87½	.....
N. Y. & Pa.	.....	.....
New England	44	45
*Southern Bell	115	130
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	130	140
*Edison Ill	85	95
*Edison Isolated	.....	.....
*United States	.....	.....
*U. S. Ill	91	100
MOTOR.		
*Daft	.....	.....
*Sprague	600	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED NOV. 30, 1886.

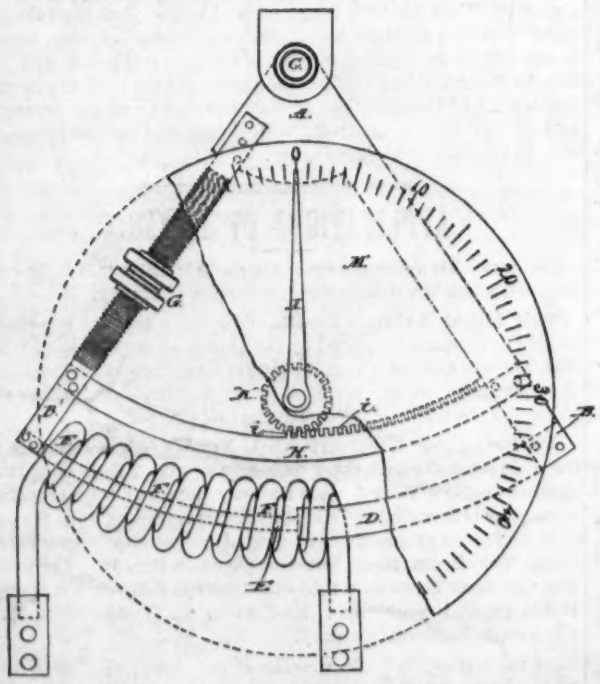
353,288. Electric Telegraph Relay; Joseph I. Conklin, Jr., Brooklyn, N. Y., Assignor of one-half to The Lewis & Fowler Manufacturing Company, same place. Application filed Jan. 30, 1886. For description see page 298 of this issue.

353,305. Regulator for Electric Arc Lamps; Hugo Henneberg, and Richard O. Lorenz, Vienna, Austria-Hungary. Application filed Dec. 29, 1885. The arc is regulated by the action of the main and shunt magnets upon a rotating magnetic disc.

353,310. Dynamo-Electric Machine; Nathaniel Shepard Keith, San Francisco, Cal. Application filed Jan. 7, 1886. A ring armature is wound in such a way that the convolutions of a fractional part, such as one-half or one-third, overlie both within and without the ring the convolutions of the remainder of the bobbins. The several bobbins are wound in alternating order, first, Nos. 1, 3, 5, 7, 9, etc., and second, Nos. 2, 4, 6, 8, 10, etc. See illustration.

(1) 353,333. Incandescent Electric Lamp; (2) 353,334. Automatic Circuit Controller for Electro-Plating Machines; (3) 353,335. Electric Locomotive; Charles J. Van Depoele, Chicago, Ill. Applications filed respectively Aug. 1, 1885, March 15, 1886, and April 28, 1886. (1) The lamp filament is composed of a bundle of loose fibres, held together by a loose wrapping of thread along the central portion and provided at the ends with clips. The object is to produce a filament of high resistance by assembling of fibres in loose, imperfect and discontinuous contact with each other. (2) The invention provides means for preventing the reversal of the main current in electro-plating machines by placing across the main conductors automatically a conductor of the proper resistance whenever the strength of the current falls below a predetermined point. (3) The invention relates to means for connecting the driving pulley of the electric motor to the wheels on which the apparatus is supported.

353,337. Microphone; Thomas Wallace and Oscar A. En Holm, New York, N. Y. Application filed Jan. 26, 1883. A bridge-piece is secured to the diaphragm by one end, while the other bears upon the centre of the diaphragm. The bridge-piece carries carbon bars, which are fixed, and a weighted bar rests upon them.



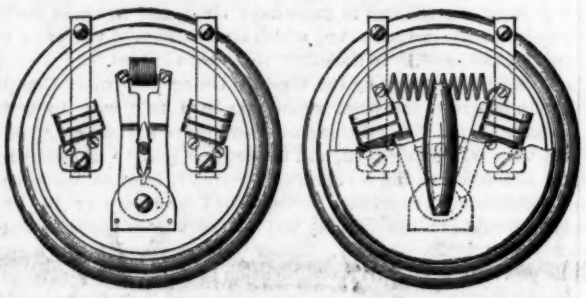
353,649. Electric Current Indicator.

353,346. Electric Therapeutic Instrument; Charles E. Baldwin, Philadelphia, Pa., Assignor to Martin V. Wagner, Marshall, Mich. Application filed July 3, 1886. The invention consists of a small therapeutical battery, in which vinegar is used as the exciting fluid.

353,349. Electric Lighting of Railway Trains; Charles E. Buell, New Haven, Conn. Application filed Aug. 9, 1882. The invention combines with the train and its electric lamp circuit, including lamps, an air-compressing apparatus on the locomotive, an air-holder on one of the cars, a motor and an electric generating machine for supplying the lamp circuit also on the car, together with suitable connections between the compressor and the air-holder, and the air-holder and the motor, whereby the motor can be driven from the air-holder whether the locomotive carrying the compressor is connected to the train or not.

353,350. Switching Apparatus and Test Circuit for Telephone Exchanges; John J. Carty, Cambridge, Assignor to the New England Telegraph and Telephone Company, Boston, Mass. Application filed Sept 6, 1886. The invention consists of a multiple switching system provided with suitable appliances for the inter-connection of double wire circuits grounded at both terminals, and in the combination of such a system with a test circuit and appliances for manipulating it, whereby the connection of any two double wire circuits may be ascertained at any switch-board in the system.

353,367. Governor for Electric Motors; Alexander W. Meston, St. Louis, Mo. Application filed July 8, 1886. The



353,603. Circuit Controller.

object is to cause the governor to respond both to changes in the power and in the load, so that any disproportion between the two will be compensated for and the balance between power and load restored before a change of speed can take place in the mechanism interposed between the power and the load. This is accomplished by interposing between the motor shaft and the driving pulley, a yielding connection, whereby, should either the shaft or the pulley change speed from any cause, the difference in speeds will act through the yielding connection to change the power of the motor and thus restore a balance between the power and the load before a change of speed takes place in the interposed mechanism as a whole.

353,393. Railway-Signal; Thomas D. Williams, Bellevue Borough, and George M. Eitemiller and John S. Lucock, Alleghany City, Pa. Application filed Feb. 26, 1886. The object of the invention is to operate from a terminal transmitting station, the signals of any one of a number of stations to the exclusion of the rest, and to accomplish this with only a single line wire. The transmitting instrument is furnished with electrical contacts equal in number to the stations, and with a contact lever which is moved from one contact to another, and operates similarly and simultaneously the lever of each corresponding instrument in all the stations. The lever serves as an index, and all the index arms point to the same contact section of all the receiving instruments throughout the system. By setting the instruments at the signal station by means of an electric current too weak to operate the signals, and then operating the latter by means of a stronger current, all the signals not designed to be operated are kept stationary. A positive current turns the signal in one direction, and a negative in the opposite.

353,403. Electrical Appliance for Dental Chairs; Levi L. Deckard, Middletown, Pa. Application filed Aug. 24, 1886. Provides means for administering a shock to persons in an operating chair preparatory to or coincident with the extracting of teeth or the performance of other painful dental operations.

353,414. Dynamo-Electric Machine; Carl Coerper, Cologne-on-the-Rhine, Prussia, Assignor to the Helios Actiengesellschaft fur Elektrisches Licht und Telegraphenbau, Ehrenfeld and Cologne, Germany. Application filed May 6, 1886. The field magnet is formed of electro-magnets, which are arranged at both sides of and parallel to the plane of rotation of the armature and connected by transverse pole-pieces, the latter being again connected by short intermediate electro-magnets also parallel to the plane of rotation of the armature.

353,475. Fire Alarm Signal Box; John Ashworth, Chicago, Ill. Application filed Aug. 19, 1886. Improvement on the Tooker fire alarm box.

353,480. Angle-hanger for Acoustic or Mechanical Telephones; Michael Gerst, Paso Robles, Cal. Application filed May 21, 1886. Two separate wires are secured to a solid bearing or support at one end and at the other to the severed ends of the in-leading and out-leading telephone wires uniting with the same at a true right angle.

353,511. Secondary Battery Element; Charles Sorley, New York, N. Y. Application filed Feb. 25, 1886. For description see page 294 of this issue.

353,536. Telephone Transmitter; William Burnley, North East, Pa., Assignor of two-thirds to Charles A. Hitchcock, same place, and Lewis F. Watson, Warren, Pa. Application filed Aug. 12, 1886. One of the electrodes slides freely on an inclined plane and the other is attached to the diaphragm. The inclined plane or table is pivoted to the frame or holder, which carries the diaphragm, and is provided with means for changing its inclination to vary the contact pressure between the electrode sliding thereon and the diaphragm electrode.

353,541. Electric Telegraph; Edward Alfred Cowper, Westminster, County of Middlesex, England, Assignor to Brent Good, New York, N. Y. Application filed August 7, 1886. Relates to improvements on an invention patented in Great Britain, June 15, 1878, No. 2,385.

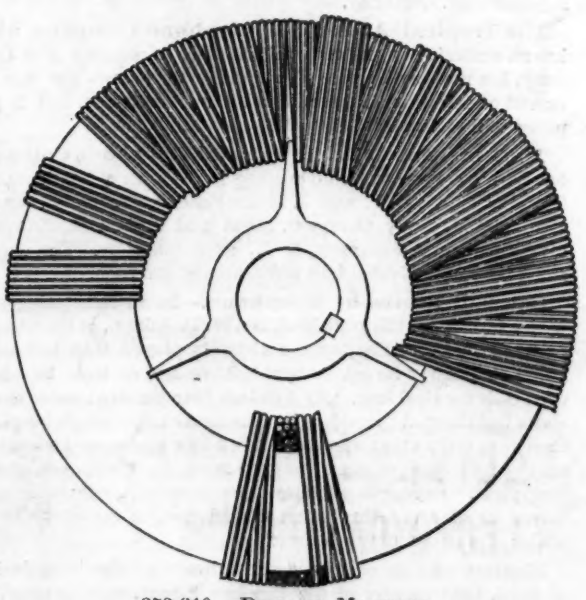
(1) 353,592. Autographic Telegraph; (2) 353,593. Autographic Telegraph; (3) 353,594. Autographic Telegraph; James H. Robertson, Rutherford, N. J. Applications filed respectively April 26, 1886, June 30, 1886, and July 31, 1886. (1) Makes the action of the armature or armatures used in the receivers of autographic writing machines more steady by immersing the armature or armatures, or some part connected therewith, in a vessel containing a liquid. (2) Improvement on inventions disclosed in previous applications, including that patented under the preceding number. (3) The objects are to utilize as fully as possible the power of the receiving electro-magnets; to dispense with adjusting springs; to so combine and arrange the transmitter and receiver as to assist the operator in the act of writing and sending.

353,598. Carbon for Electrical Purposes; Edgar Shaw, Lynn, Mass. Application filed April 11, 1885. For description see page 292 of this issue.

353,603. Electric Circuit Controller; William Stanley, Jr., Great Barrington, Mass. Application filed Dec. 11, 1885. The object of the invention is to effect the breaking of the circuit by a quick movement independent of the speed with which the manual part of the switch is operated. The illustrations show the two positions of the circuit controller, one representing the arms of the U shaped circuit-closer making electrical contact with two contact-pieces, and the other showing them drawn away from the contact-pieces by the force of the spiral spring.

353,637. Electrical Apparatus for Working Valves; Henry Likly, Charles A. Carpenter, and Fred. B. Graves, Rochester, N. Y. Application filed Aug. 2, 1886. The invention relates to mechanism for actuating automatically or at will a valve located in a fluid, liquid, or gas supply pipe, or main, to control the flow.

353,643. Electric Arc Light; George C. Pyle, Cuyahoga Falls, O., Assignor to the American Electric Headlight Company, Indianapolis, Ind. Application filed May 5, 1886. For description see page 298 of this issue.



353,310. Dynamo Machine.

353,649. Electric Current Indicator; Montgomery Waddell, Coburg, Ontario, Canada, Assignor to himself and William S. Andrews, New York, N. Y. The invention consists of a pendulum in the form of a quadrant or sector having a curved bar of soft iron projecting from the lower end of one of its arms in an arc, the centre of which is the pivot of the pendulum; and it consists further of a fixed coil of copper wire curved in an arc corresponding to that of the iron bar, the coil being mounted in front of the bar so that the latter may swing freely in and out of the coil when vibrating upon its axis. When the coil is included in an electric circuit, the vibrating bar will be drawn more or less into the coil by the attraction of the current, and the extent of the movement thereby imparted to the pendulum will afford an accurate indication of the intensity of the current. See illustration.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.